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AUTHOR
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FOREWORD

Citations of commercial organizations and tradenames in this report do not constitute an official Department of the Army endorsement or approval of the products or services of these organizations.

In conducting the research described in the report, the investigators adhered to the "Guide for the Care and Use of Laboratory Animals", prepared by the Committee on Care and Use of Laboratory Animals of The Institute of Laboratory Animal Resources, National Research Council (DHEW Publication No. [NIH] 78-23, Revised 1978).

For the protection of human subjects, the investigators have adhered to policies of applicable Federal Law 45CRF46.

The findings in this report are not to be construed as an official Department of the Army position unless so designated by other authorized documents.

This data shall not be disclosed outside the government and shall not be duplicated, used, or disclosed in whole or in part for any purpose other than that provided in the contract. This restriction does not limit the government's right to use information contained in the data if it is obtained from another source without restriction.

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0.0 ABSTRACT

An improved controlled-release arthropod repellent formulation for topical application to a person's exposed skin areas that provides extended protection against biting arthropods, which is safe and agreeable to use, which is more compatible with other current and projected military materials and systems than the Army's current 75% N,N-diethyl m-toluamide (DEET) in alcohol formulation and which complies with the registration requirements of the Environmental Protection Agency (EPA) has been developed in Phase I and Phase II of this contract. The Phase II repellent containing 35% DEET and an acrylate polymer has been refined to improve its low temperature stability. This new Phase III formulation was the basis for the EPA insect repellent registration submitted on May 27, 1987.

The acrylate polymer used in the repellent formulation had to be scaled-up first. A few problems were encountered but they were overcome and the polymer was prepared successfully in the required quantity. It was shipped to Walgreens.

All the other ingredients for the insect repellent formulation were ordered and sent to Walgreens. A 100 gallon pilot batch was prepared first. The repellent lotion from this batch was very nice. It met all of the product specifications and the lotion was released for packaging. Two thousand eight hundred tubes were filled and sealed on an older, labor-intensive filling machine. The label on the tubes were not centered very well and the seal was not as cosmetically nice as it could have been. These tubes were shipped to 5 different locations for additional field evaluations and testing.

A 1000 gallon production trial batch of repellent lotion was prepared. The manufacturing process seemed to run acceptably; however, the final cosmetic appearance of the lotion was not quite as good as the pilot batch. The product met its specifications and was released for packaging. A new packaging line was used for the latter and the tubes were very nice. The label was centered and the sealed end of the tube was perfect. These tubes were stored until a disposition can be decided upon.

A technical data package covering the production processes, quality control and product specification was written for the Insect/Arthropod Repellent Lotion.

1.0 INTRODUCTION

Personal Care Products Department of the Consumer Specialties Divsiion of 3M, received the third phase of a U.S. Army Medical Research and Development Command contract to develop a longer lasting, cosmetically acceptable, personal use arthropod repellent formulation. This phase consists of a "demonstration of pre-production pilot manufacturing of the repellent formulation, a demonstration of quality control, a definitization of production processes, finalization of a technical data package, development of a production plan, and registration of the product with the EPA".

Our final Phase II formulation was an oil-in-water emulsion containing 35.00 percent N,N-diethyl m-toluamide (DEET) and 5.83 percent acrylate polymer. This formulation provided laboratory 95% protection times against Aedes aegypti mosquitoes of 14-15 hours, 10-11 hours and 14-15 hours in the constant high humidity, variable high humidity and basic hot climatic conditions, respectively. The same formulation evaluated in the field in variable high humidity climatic conditions provided 10.7 ± 1.8 hours of complete protection against Aedes sollicitans mosquitoes and 12.3 ± 1.8 hours of complete protection against Anopholes quadrimaculatus mosquitoes. The formulation was shown to be acceptable to 88% of men and women of military age and was shown to be less toxic to animals and humans than the 75% DEET/alcohol formulation. The repellent is packaged in individual 2 ounce, olive drab, high density polyethylene tubes with a noiseless, flip-top cap. The tubes are labeled per the EPA Registration Standard and Guidance Package.

2.0 DISCUSSION

2.1 Phase II Formulation Stability Data

At the end of the Phase II contract, the final candidate formulation was set up in aging studies at 35°F, room temperature and 113°F.

2.1.1 Three Months Data

The evaluation of the Phase II formulation aged at 113°F, room temperature and 35°F was conducted at 3 months. The different lots were checked for viscosity, pH, percent DEET, percent separation and percent weight loss. In addition, freeze/thaw stability data was determined on room temperature samples of each lot. The specific data appear in Figure I,

Appendix A attached. Compared to the initial values, the formulation viscosities of all 3 lots doubled over the 3 months in all the aging conditions. This is not an abnormal occurrence when a Cab-O-Sil thickener is used. For the 113°F samples there was a slight pH drop. Also there was a weight loss for these samples, but it was comparable to what was seen in our Phase II package design studies (See Figure II). The room temperature samples looked normal except for a slight separation evident in some. This separation was more pronounced in the 35°F samples where 6 and 12.3% separations were observed at 1 and 3 months respectively. This low-temperature instability was confirmed when room temperature retain samples were subjected to a freeze/thaw stability tests. A 23% separation occurred on the first cycle.

2.1.2 Six Months Data

The six month stability data appear in Figure III. The formulation viscosities and pHs at each condition seemed to have leveled out. They were quite similar to what they were at 3 months (see Figure I). The percent separation of the room temperature and 35°F samples continued to increase. This separation also showed itself in the % DEET analysis. The lower values reinforce the fact that DEET had separated from the emulsion phase. There was a 5-6% weight loss from the tubes of the samples aged at 113°F for the 6 months. (Samples aged at 113°F for 3 months are equated to two year of aging at room temperature). The weight loss could be water or water and other ingredients. Based on the percent DEET, which averaged 37.1%, the 113°F aged samples should still be quite effective as an arthropod repellent.

2.2 Improvement of the Phase II Formulation

The separation seen in the 35°F and the room temperature aging samples of the Phase II formulation was unacceptable. This low temperature instability had to be improved.

2.2.1 Identification of Raw Materials Which Affect Low-Temperature Stability of the Formulation.

The ingredients in the formulation which affected low temperature stability were identified using a freeze/thaw stability test method. Therein, test tubes of the fomulation were frozen for 20 hours and then removed from the freezer. After allowing the tubes to equilibrate to room temperature, they were centrifriged for 15 minutes to accelerate any phase separation. This process was usually repeated for a number of cycles and the percent separation calculated each time.

Room temperature retain samples from the Phase II statistical design experiments were evaluated via the above freeze/thaw method. The following materials were identified as affecting the stability of the formulation. Their effects, positive or negative, are also noted.

Lexol PG-865 (propylene glycol dicaprylate/dicaprate) emollient oil	Negative
Lexemol AS (glyceryl monostearate) emulsifier	Negative
Liponic EG-7 (glycereth-7) humectant	Negative
Carbowax 400 (polyethylene glycol) humectant	Positive
Varonic LI420 (polyethylene glycol-200-monotallowate) emulsifier	Positive
Varonic LI48 (polyethylene glycol-82-glyceryl monotallowate) emulsifier	Positive
Arlamol E (polypropylene glycol-15-stearyl ether) emollient oil/stabilizer	Positive
Adol 63 (cetyl stearyl alcohol) waxy emollient/stabilizer	Positive
Cab-O-Sil M-5 (fumed silica) thickener/leveling agent	Negative
Veegum (magnesium aluminum silicate) thickener	Positive
Natrasol (hydroxyethyl cellulose) thickener.	Positive

2.2.2 Statistical Design Experiment to Define Ingredient Effect

The specific effect that each of the above materials had on freeze/thaw stability was determined via a 2^{7-4} fractional factorial design experiment for the first eight ingredients and a 2^3 factorial design experiment for the thickener system. The following regression equations define the effect of each ingredient on the freeze/thaw stability:

Stabilizer Freeze/Thaw % Separation Equation

% Separation = 13.6% - 3.82% (Varonic LI48)

- 3.6% (Adol 63, Arlamol E)

+ 2.7% (Lexol PG-865) + .9% (Liponic EG-7)

- .8% (Varonic LI420) - .4% (Carbowax 400)

Thickener Freeze/Thaw % Separation Equation

% Separation = 1.98% + 2.23% (Cab-O-Sil M-5)

- 1.92% Veegum - 1.44% Natrasol - 1.71% (Cab-O-Sil*Veegum)

+ 2.67% (Cab-O-Sil*Natrasol) + .44% (Veegum*Natrasol)

+ 4.46% $(\text{Cab-O-Sil})^2$

In the equations, the underlined ingredients had a significant effect at $\geq$ 95% confidence interval. A smaller percent separation is desired. Therefore, any ingredient which contributes to reduce the separation will have a negative sign in the equation and those which increase the separation (decrease the stability) will have a positive sign. In other words, more Varonic LI48, Adol 63, Arlamol E, Veegum and Natrasol contribute to a more stable formulation while more Lexol PG-865 and Cab-O-Sil would make the formulation less stable.

2.2.3 Improved Formulations

These regression equations were used to predict which combination of the statistically significant ingredients would provide the most stable formulation with respect to low temperature stability. The formulas are shown in Figure IV. The Phase II formulation in triplicate ('75907-11-2, 4, 6) was included for comparison.

2.2.4 Evaluation of New Formulations

The prepared formulations were evaluated for freeze/thaw stability (see Figure V). The Phase II repellent had 4% separation the first cycle and 20% by the fifth cycle. By comparison, the new formulations 462-4-1 through 4 and 75907-11-1, 3 and 5 had essentially no separation through 7 freeze/thaw cycles. The last 3 formulations are replicates of the same formulation. Formulations 462-5-2 and 3 were stable through 5 cycles. Of the freeze/thaw stable formulations, 462-4-1, 2 and 3 and 75907-11-1, 2 and 5 showed 0% separation after 3 weeks at 140°F. Therefore, the choice for a new formulation was between 462-4-1, 2 and 3 and 75907-11-1.

From a toxicological point of view, less of a problem will probably result from a change in the ingredients if they are reduced in concentration as opposed to increasing them. By comparing the new formulas to the Phase II formula, (75907-11-2) in Figure IV, one can see that for 462-4-1, 2 and 3 the concentration of 5 ingredients increase and 3 decrease with respect to the Phase II product. Formulation 75907-11-1 has 3 ingredients decreasing in concentration and only 3 ingredients increasing. Therefore, PCP chose formula 75907-11-1 as the new Phase III formula.

2.2.5 Phase III Versus Phase II Formulation

The new Phase III forumulation was compared to the Phase II repellent to ensure that a loss in aesthetic acceptability and in DEET retention did not result because of the formulation change. Aesthetically the two formulations tested the same with values of 11.1 $\pm$ 6.2 and 11.0 $\pm$ 5.0. One would have predicted that the decrease in Cab-O-Sil would have impacted negatively in the aesthetic perception. Apparently the other changes in the formulation offset this.

Evaluation of the six-hour DEET retention for both formulations was also positive. The new formulation retained 74.5 $\pm$ 13.2% DEET on the skin after six hours versus 70.1 $\pm$ 11.0% for the Phase II product.

2.2.6 Toxicological Impact of Phase III Formulation

3M's resident toxicologist was contacted about the changes in the formulation. In his reply (attached - Figure VI) Dr. Griffith stated that the differences between the new Phase III formulation and the Phase II formulation are, toxicologically, insignificant.

2.2.7 Phase III Formulation Laboratory Scale-Up/Sample Preparation

The new formulation was prepared on a larger scale in order to generate enough material for additional longer-term stability studies. Samples of this formulation were set to Dr. Raj Gupta (LAIR) (12) and to Colonel Reinert at Fort Detrick (36). The samples were going to be used for mosquito repellency evaluations to ensure that the formulation change did not affect its efficacy.

Larger three thousand gram batches of the new Phase III lotion were also prepared to demonstrate that the formulation could be scale-up successfully. Colonel Reinert requested 100-150 tubes of this repellent to be used for additional evaluations. Therefore, 100 tubes were packaged and sent.

2.3 Environmental Protection Agency

To be able to ship the repellent lotion manufactured at Walgreens for Phase III of this contract, the product had to be registered with the Envionmental Protection Agency (EPA). The registration process at EPA can take up to 180 days or 6 months; therefore, the data package for the new Phase III repellent lotion had to be finalized and sent in as soon as possible if PCP had any intentions of trying to ship the final product by the end of the contract.

2.3.1 Registration of the Insect/Arthropod Repellent Lotion.

The bulk of the registration package for the EPA had been put together during Phase II of the contract. However, the low temperature instability problems of the Phase II formulation which surfaced after the completion of Phase II necessitated a reformulation to obtain a new, more stable Phase III formulation. These changes were incorporated into the EPA registration package.

Dr. Arturo Castillo, Product Manager of the Insecticide-Rodenticide Branch of the EPA was contacted about Personal Care Products' concerns on the formulation change and whether PCP would have to do any toxicity retesting. He stated that if the changes were small and if they had little toxicological impact on the formulation, then PCP could use their Phase II toxicity data. He also stated that the EPA would make the final decision whether or not the changes had a toxicological impact. In addition, he informed PCP of a new PR Notice 86-5 that the data package had to follow. Because of the urgency of our application he also suggested that we hand deliver the

application to the EPA. Then if any changes needed to be made, they could be taken care of right there. The registration data package was delivered to Mr. Tavano of the EPA on May 27, 1987 by Dr. Frank Griffith (3M Toxicology) and the author. It was reviewed by Mr. J. Tavano to make sure it was complete and by Mr. J. Carlee's group to ensure that the format was correct. One additional form was needed which was filled out in Mr. Tavano's office.

A receipt acknowledging PCP's request for registration of an "Insect/Arthropod Repellent Lotion" and a "Report of Analysis for Compliance with PR Notice 86-5" were received from the EPA. In the latter PCP was informed that Good Laboratory Practices (GLP) approvals prior to the toxicological studies were not sufficient. Therefore, the proper forms, signed after the fact that GLPs were followed, were obtained and forwarded to the EPA. In addition, the legibility of some of the material in a couple of studies was reported as "marginal". They were referring to a copied gas-chromatographic DEET analysis of the repellent lotion which did not reproduce very well. This assay was rerun and better copies were sent to Mr. Castillo. A cover letter listing the corrections is attached in Appendix A, Figure VII.

A copy of the registration package was sent to Colonel Reinert and to Mr. L. Rutledge (LAIR). Also, a copy of PR Notice 86-5 was sent to Colonel Reinert.

2.3.2 Shipment of 2,000 Samples of Production Repellent Lotion

Personal Care Products/3M had been requested to send 2,000 2-ounce tubes of repellent to the Army for evaluation prior to the probable issuance of a final EPA registration number for said product. A letter was put together explaining the situation to the EPA (copy sent to Colonel Reinert). Personal Care Products/3M's position was that this shipment of product does not go against the intent of the law. A company can manufacture a pesticide product at a plant and ship it back to the parent company for evaluation. In this instance, PCP/3M was working for the Army, under a contract, and would simply be shipping a "sample" of the manufactured product back to the parent company, the Army. The Army was going to use the material for research purposes for additional, controlled evaluations.

The letter was delivered to the EPA on May 27, 1987. No response was received by the last week in June so Mr. Tavano (EPA) was contacted by phone. Mr. Craig Sterling also contacted Mr. Tavano and a number of other people before

permission was finally obtained to ship 2,000 samples. No special labeling was required on the shipping boxes. A letter was enclosed with each box stating that the samples were for research testing only.

2.3.3 Shipment of 38,000 Tubes of Repellent

The Phase III contract calls for the delivery of approximately 38,000 additional tubes of repellent lotion to the Army. To ship these tubes a number of criteria will have to be met: an EPA registration number will have to have been issued; this number probably will have to appear on the package; and the label on the tube will have to comply with all of the EPA requirements and have their approval. If all that had to be changed was the EPA number on the tubes, a pressure sensitive label containing the appropriate numbers could be applied. Of course, this would mean re-handling the tubes which would involve some additional expense. Personal Care Products/3M will have to wait and see what will be required and if it is still desired that the tubes be shipped.

2.4 Acrylate Polymer Manufacture

The experimental polymer used in the repellent lotion had been prepared in small quantities in the laboratory during Phase I and Phase II of this project. The polymer required for the Insect/Arthropod Repellent Lotion production at Walgreens dictated that the polymer be prepared on a larger scale also. Therefore, the polymer was prepared at Chemolite (a 3M manufacturing plant) during the first week of June. The polymerizations were scheduled to be run in 1000 lb. batches.

As with any new manufacturing procedure, the first run or two constitute a learning process for the production personnel, as well as a time to make adaptations in the procedure to make a better product. Such was the case here; the first production batch had to be scrapped. In the second run an exotherm occurred and polymer with a 3300 cps. viscosity was obtained. This was a little below the visiosity specification; so the polymer was set aside for future disposition. The third production run went very well. The reaction exothermed in a very controllable manner and was complete after a conversion of monomer to polymer of greater than 99.5% was obtained. The final polymer diluted in the laboratory to 25% polymer in DEET gave a Brookfield viscosity of 5550 cps. The target was 6000 cps. with an acceptable range of 4500 - 7500 cps. Unfortunately, the lot was mistakingly diluted to 21.66% polymer because of problems associated with an in-process test.

However, as long as the percent polymer was known this was not a problem since the polymer was already shown to be within specifications.

Approximately 2000 lbs. of the polymer was shipped to Walgreens in Chicago for the compounding in the "Insect/Arthroped Repellent Lotion."

2.5 Repellent Lotion Manufacture

A manufacturing process for the production of the Insect/Arthropod Repellent Lotion based on laboratory experiences appeared in the Phase II Technical Data Package. This process in turn was adapted to production equipment by Dr. P.K. Sundaram (at Walgreens). The major concern in scaling-up a process such as this, was whether or not the different kettles, mixers, homogenizers, etc. used in the production would drastically affect the final product. That is, would the production lotion be as good as the laboratory lotion? Hopefully, it would be better.

2.5.1 Pilot Batch (100 Gallons)

The initial production of the repellent lotion was scheduled to take place in a 100 gallon kettle. This size was chosen because it was intermediate between the 3 gallon laboratory batches and the 1000 gallon production trial batch to be run later. If any problems in the process were encountered, the appropriate changes could be made in the manufacturing process prior to the 1000 gallon batch. In addition, if the product turned out to be unsatisfactory then a smaller amount of material would have to be disposed and then another pilot batch could be prepared.

The 100 gallon pilot batch was run on July 6, 1987 at Walgreens in Chicago. The manufacturing process went very smoothly. The reverse blade agitation in the kettle gave excellent mixing and as a result the final Insect/Arthropod Repellent Lotion looked very nice. A yield of 102% of homogenized lotion was reported (see attached Appendix B Pilot Batch manufacturing records). The lotion had an average DEET content of 34.7% and a lotion viscosity 163,000 (#TE @ 0.6 rpm) (21,600 cps - # TB @ 5 rpm). The specifications are 31.58 to 36.75 percent DEET and 150,000 -- 250,000 cps respectively. The viscosity of the lotion will probably increase some with time. A copy of the certificate of analysis for the lotion is attached at the end of the Pilot Batch manufacturing process in Appendix B. The lotion was released for packaging.

2.5.2 Production Trial Batch (1000 Gallon)

The minor manufacturing process improvements suggested in the pilot batch were incorporated into the process for the 1000 gallon production trial batch. Again, a different kettle and different stirrers, etc. would be used for this larger batch as compared to the pilot batch. In addition, it would take more time to heat this larger batch up to temperature and conversely more time to cool the batch. Would these as well as the other changes affect the final product?

The production trial batch was run at Walgreens on July 27, 1987. The preparation of the water and the oil phases for the formulation went very smoothly. However, a problem was encountered when the water phase was added to the oil phase. Usually this addition was done with the agititators (stirrers) turned up very high, to get efficient mixing. This was what the manufacturing process specifications requested. The equipment configuration dictated that the stirrers be turned off during the addition of the water phase to the oil phase. When the addition was finished, they were turned back on and the process completed. At the end, just prior to homogenization, the final formulation did not appear to be as creamy as the pilot batch. For this reason the pressure on the sonatator was increased from 400 to 800 psi and a smaller orifice was used in an attempt to improve the appearance of the formulation. These changes did help the production trial batch lotion but it still was not as nice as the pilot batch. The final lotion did meet all of the release specifications with 35.3% DEET content and a viscosity of 222,300 cps.

A copy of the certificate of analysis is attached of the production process (Appendix B). The yield for the manufacturing process again was 100%.

The production trial batch was released for packaging.

2.5.3 Manufacturing Clean-Up

The repellent lotion is a tenacious product by design when placed on the skin. It is also a hard product to clean from equipment. Walgreens experienced a clean-up problem for both the pilot and the production trial batches.

A procedure to clean the production equipment was developed in the lab. It consisted of heating an aqueous 4% solution of "Alconox" (Alconox, Inc.; New York, NY 10003) to 80°C for 30 minutes. The kettle was then rinsed with hot water to remove the soap film.

2.5.4 Accelerated Stability Testing of the Manufactured Lotions

Accelerated low-temperature stability of the pilot batch and the production trial batch was determined by subjecting samples of the formulations to freeze/thaw cycling with centrifuging between to accentuate any separation. The data is in Figure VIII.

One can see that the pilot batch had freeze/thaw stability (0% separation) very similar, actually better, than the laboratory prepared Phase III formulation. By comparison the production trial batch formulation was not quite as stable with a separation of 3-4 percent. The encouraging thing was that the separation of the latter did not increase as additional freeze/thaw cycles were run. In addition the latter was definitely more stable than the Phase II formulation.

The pilot batch formulation was as stable as any laboratory prepared product. The production trial batch formulation was not quite as stable as hoped, but more so than the previous Phase II formulation.

2.5.5 Production Summary and Proposed Recommendations

The pilot production batch of the Insect/Arthropod Repellent Lotion went very well at Walgreens. The final product looked very nice and met Personal Care Products/3M's freeze/thaw stability criteria. This demonstrated that the lotion could be prepared on a larger production scale satisfactorily.

The larger scale production trial batch appeared to go nicely also. However, the lotion from this batch, while meeting all the specifications etc. was not quite as nice as the pilot batch in its appearance and in its freeze/thaw stability. These differences are probably do to the fact that the kettle agitation was turned off when the water phase was being added to the oil phase. This was contrary to the written procedure in the manufacturing specifications and contrary to the acceptable procedure for making a good, stable emulsion.

Personal Care Products/3M recommends that the 1000 gallon manufacturing process be repeated as a second production trial batch prior to letting this product out for procurement for future Army needs. In a situation like this, where it is realitvely certain that good product will be produced, Personal Care Products/3M would normally have the product packaged. Then the material would be sold if it was acceptable.

A more economical approach to demonstrate that acceptable material can be prepared in the 1000 gallon kettle would be simply to manufacture 800 gallons of the lotion and then store it in 55 gallon drums.

This bulk stored lotion could be packaged into tubes with EPA approved labels at a later date.

A cost proposal has been put together covering a second production trial at Walgreens in which the lotion would be bulk packaged. It is attached in Appendix D.

2.5.6 Final Manufacturing Process Specifications

All of the recommended changes suggested by the pilot batch and the production trial batch have been incorporated into a final manufacturing process. It is attached in Appendix B.

2.6 Packaging

The 2 ounce, olive-drab, high density polyethylene (HDPE) tube was the preferred package for the insect/arthropod repellent lotion at the end of the Phase II contract.

2.6.1 Dispensibility

During the interm between Phase II and Phase III the percent dispensibility from the HDPE tube was questioned. It was felt that a higher percent of the formulation should be dispensed. Additional studies were conducted comparing both the Phase I and Phase II formulations in HDPE tubes and LDPE (low density polyehylene) tubes. From the data in Figure IX it can be seen that a slightly better dispensibility was obtained from the more pliable LDPE (92.1%) than from the HDPE (88.9%) tubes. However, dispensibility is not the entire story for tube construction. When the long term aging data of the lotion in both tubes are compared it can be seen that there was a lower weight loss from HDPE tubes (1.8%) than from the LDPE tubes 5.2%. (See Figure II).

Based on these comparisions the HDPE tube was still the tube construction of choice for Phase III.

2.6.2 Label and Tubes

The U.S. Army requested 2000 units of packaged product from a manufacturing run be shipped to them for evaluation in the field. The product was to be received by July 1, 1987.

Obtaining the tubes necessary for the production lotion took a little longer than anticipated. The problem appeared to be the number of times that the label copy for the silk-screen printing had to be sent back and forth between 3M and the tube manufacturer for corrections. This caused a delay in tube manufacture and necessitated a contract modification on the shipment of the 2000 samples to the Army from July 1 to July 13, 1987.

After the above there are still corrections that need to be made on the label. The word (cream) following "Insect/Arthropod Repellent Lotion" on the front label was suppose to be removed. The Skin Application "directions" were suppose to be in larger print. There is ample room on the back of the tube to do the latter. Also, actual numbers will have to replace the XX's for the following items:

6840-00-XXXXX
TYPE (XXX)
Federal Specification XXXXX
EPA Reg. No. XX
EPA Est. No. XXXX

In addition the EPA is reviewing the "draft label" to ensure that it meets all of their criteria. If they require any changes, these also will have to be made to the "final Label."

2.6.3 Pilot Batch

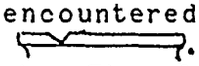
The 2000 requested samples for the Army were obtained from the 100 gallon pilot batch. They were filled on an older (KALEX) filling machine. The cosmetic appearance of the final tube seal was not as good as it could be. It was wavey in appearance and puckered the tube near the seal. In addition the front and back labels weren't centered very well. Personal Care Products was informed that these faults would be corrected on the 1000 gallon production trial batch.

The filled tubes were sent to the following addresses:

800 tubes President
U.S. Army Armor Engineer Board
ATTN: ATZK-AE-EN (Capt. Lee)
Fort Knox, KY 40121-5470

400 tubes	Mr. Karl Schreck Insects Effecting Man and Animals Research Laboratories P. O. Box 14565, USDA Gainesville, FL 32604
400 tubes	Commander Letterman Army Institute of Research Dept. of Cutaneous Hazards ATTN: SGRD-UL-CH (Mr. Louis C. Rutledge) Presidio of San Francisco, CA 94129
100 tubes	Product Manager for Arthropod Repellents U.S. Army Medical Material Development Activity ATTN: SGRD-UMB (Col. Reinert) Bldg. T-622 Fort Detrick Frederick, MD 21701-5009
300 tubes	3M

2.6.4 Production Trial Batch

The packaging of this product on a new filling machine proceeded very smoothly. The labels on these tubes were centered properly and the tube seal was very nice. The only problem encountered on a few of the tubes was a V in the sealed end  . This was caused by the tubes being slightly too short. Therefore the specifications for the tube will be increase 1/4" in length to 3 13/16". These filled tubes will be stored until a suitable disposition can be decided upon.

The packaging specifications are attached in Appendix C.

2.7 Technical Data Package

A Phase III Technical Data Package was put together for the manufacture of the Insect/Arthropod Repellent Lotion. It included the manufacturing process, quality control and specifications for the manufacture of the repellent lotion.

2.8 Production Plan

A production plan which contains all the time-phased production actions will be sent separately.

2.9 Premanufacturing Notice

A premanufacturing notice (PMN) for the EPA will have to be put together on the acrylate polymer in DEET before this ingredient can be used for a non-research and development use. Use in a commercial product would constitute such a use.

The process of putting together a PMN will take up to "six (6) months" to finalize. This time frame has to be taken into consideration when any 3M "Insect/Arthropod Repellent Lotion" is ordered in the future.

2.10 Extended Shelf Life Studies

The Phase III contract was extended in response to a request from the U.S. Army Medical Research Acquisition Agency to modify 3M's proposal for extended shelf life studies of the Phase III production formulation dated January 23, 1987. It was specifically requested that all testing proposed for the three month and the six month time intervals be removed and then added as an extension to the current Phase III contract. The proposed extended shelf life study would include only the studies conducted at one, two, three, four and five year intervals. Figure X lists the stability tests, aging conditions and time frames for the studies.

2.11 User Training Package

The detailed training package developed during Phase II for procedures, techniques, amounts of repellent formulations to apply, safety considerations, etc. for training the user was refined after the "Draft Final Report" of Phase II and the changes were included in the Final Technical Report for Phase II.

3.0 SUMMARY

A low temperature instability problem surfaced in the aging studies of the final Phase II Insect/Arthropod Repellent Lotion. Those ingredients which contributed positively or negatively to the formulation stability were identified via freeze/thaw studies of retain samples. Once identified the relative effect of each was determined via statistical design experiments. In this manner an improved Phase III formulation was defined which was far superior in its low temperature stability. The changes in the new formulation were kept to a minimum in order to have as small of a toxicological impact as possible.

The Phase III formulation was as aesthetically pleasing as the Phase II formulation. In addition the new formulation retained slightly more DEET on the skin via the 6-hour DEET substantivity test.

The Phase II EPA data package was changed to reflect the differences in the new Phase III formulation and to conform to the PR Notice 86-5. Dr. Frank Griffith (3M Toxicologist) stated that the differences were small and were toxicologically insignificant. The EPA will assess the changes and make the final decision of whether or not PCP/3M will have to do any additional toxicity testing. The data package was submitted to the EPA on May 27, 1987.

The acrylate polymer used in the Insect/Arthropod Repellent Lotion also had to be scaled-up from laboratory size to production. This was carried out at Chemolite, a 3M manufacturing facility in early June. As with most manufacturing process scale-ups, a learning curve is usually encountered and this turned out to be the case here. By the third production run most of the problems had been worked out and very good polymer was finally prepared. The only glich occurred with a new in-process test to measure the percent polymer in the solution. It gave erroneous results causing the polymer to be diluted to 21.67%. However, as long as the percent polymer in the solution was known this was not a problem.

The acrylate polymer as well as the other ingredients required to prepare the repellent lotion were received by Walgreens in Chicago. Difficulties in obtaining the labeled tubes caused the production to be postponed until the 6th of July. The first pilot batch of the lotion was 100 gallons. The formulating process went very nicely. The final product met all of its specifications and was released. Two thousand units of this product in 2 ounce HDPE tubes were packaged on an older filling line. The labels were not lined up on the tubes as accurately as they should have been nor were the tube seals as cosmetically acceptable as they could have been. The yield on the formulation process was recorded as 102%. A realistic packaging yield was not obtained because only half of the lotion could be packaged because of the limited number of tubes on hand.

The 2000 samples were sent to five different locations for additional field evaluations and other tests.

After the initial pilot batch, a 1000 gallon production trial batch was prepared. The process went okay; however the final lotion did not look as good as the pilot batch lotion. Later it was learned that the agitation in the kettle had been turned off during the combination of the water and oil phases. This may explain why the formulation was not as smooth as the pilot batch. As before the yield for the production trial batch lotion was 100%. The lotion met all of its specifications. It was packaged on a new IWKA filling line into the 2 ounce HDPE tubes. The seal on the tubes was very nice this time and the labels were aligned perfectly. The packaging yield was 94.0% acceptable tubes, 4.5% destroyed tubes and 1.5% of the tubes unaccounted for.

Freeze/thaw stability studies were run on the production repellent lotions. The pilot batch lotion was as stable as any laboratory prepared lotion, while the production trial batch lotion had 2 - 4% separation after 7 cycles. The old Phase II formulation had 20% separation by the 5th cycle.

In addition, a technical data package was written covering the production, quality control and specification for the manufacture of the repellent lotion.

4.0 CONCLUSION

The EPA registration data package for the new Phase III Insect/Arthropod Repellent Lotion has been delivered. A Technical Data Package for the production of the repellent lotion has been written as well as a Production Plan.

The scale-up of the acrylate polymer, used in the lotion, went quite nicely after the inital runs. As with any polymerization it has to be monitored quite closely during the key reaction time period. Very few problems should be encountered with this process in the future.

Two production batches of the Repellent Lotion were prepared by Walgreens. In the pilot the product obtained was very nice; however, it was packaged on an older piece of equipment and the cosmetic appearance of the tubes was not as good as it could have been. In the production trial a miscommunication resulted in repellent lotion which wasn't quite as good as the pilot batch. The lotion met all of its release specifications and was packaged on a new filling line. The finished tubes were very nice.

It has been demonstrated that the repellent lotion can be prepared and packaged satisfactorily on a production scale. What remains to be demonstrated is that these two functions can be accomplished for the same production run. I don't see this as a serious problem. I believe that good repellent lotion can be prepared and packaged on a production scale.

5.1 Appendix A - Figures

FIGURE I

PHASE II REPELLENT FORMULATION STABILITY

Initial	Viscosity (cps)	pH	% DEET	% SEPARATION	% WEIGHT LOSS
49-47-4	153,000	7.15	(38.2)	0	0
49-52-1	134,000	7.12	(38.2)	0	0
49-52-2	122,000	7.22	(38.2)	0	0
Room Temperature					
49-47-4	373,000	7.06	39.9	2.0	.2
49-51-1	315,000	6.88	38.6	0.0	.2
49-51-2	311,000	6.93	40.0	2.0	.2
113°F - One Month					
49-47-4	511,000	7.26	38.3	0	.5
49-51-1	589,000	7.23	38.5	0	.7
49-51-2	661,000	7.33	38.5	0	.7
113°F - 3 Months					
49-47-4	357,000	6.86	42.0	0	2.1
49-51-1	415,000	6.82	38.5	0	2.0
49-51-2	304,000	6.77	41.2	0	2.0
Freeze/Thaw					
49-47-4	-------	7.21	----	23.3	0
49-52-1	-------	7.13	----	23.3	0
49-52-2	-------	7.20	----	23.3	0
35°F - One Month					
49-47-4	425,000	7.33	39.9	2.0	0
49-52-1	300,000	7.23	37.4	7.7	0
49-52-2	410,000	7.34	36.8	9.0	0
35°F - 3 Months					
49-47-4	-------	----	----	12.5	0
49-52-1	-------	----	----	12.0	0
49-52-2	-------	----	----	12.5	0

FIGURE II*

PACKAGE AGING DATA

PACKAGE COMPOSITION	PERCENT WEIGHT LOSS (2 MONTHS) ROOM TEMPERATURE	120{o}F
LDPE 1004 overcoat	.4%	7.6%
LDPE Phase I tube 1004 overcoat	.3%	5.6%
LDPE UV; TP-46	.2%	5.2%
HDPE UV; TP-46	.1%	1.8%

LDPE = low density polyethylene
HDPE = high density polyethylene

* Figure XXX from Phase II Final Technical Report

FIGURE III*

PHASE II REPELLENT FORMULATION - SIX MONTH STABILITY

CONDITION	FORMULATION	VISCOSITY (cps)	pH	% DEET	% SEPARATION	% WEIGHT LOSS
Initial Values	49-47-4	153,000	7.15	(38.2)[1]	0	0
	49-52-1	134,000	7.12	(38.2)	0	0
	49-52-2	122,000	7.12	(38.2)	0	0
113°F	49-47-4	530,000	6.97	37.0	T	4.9
	49-52-1	424,000	6.69	37.1	0	5.9
	49-52-2	486,000	6.70	37.3	0	6.5
Room Temperature	49-47-4	376,700	7.15	33.4[2]	8.3[3]	0.4
	49-51-1	332,800	7.17	35.8[2]	0	0.5
	49-52-2	314,600	7.16	34.4[2]	6.7[3]	0.5
35°F	49-47-4	396,400	7.19	31.6[2]	20[3]	0.0
	49-51-1	438,100	7.25	31.5[2]	14[3]	0.1
	49-51-2	488,800	7.28	30.7[2]	18[3]	0.0

1 - Average value at one month
2 - Formulation separation caused less DEET to be in emulsified portion
3 - Approximate values because of difficulty in reading

* Figure VI, May 1987 monthly report, Phase III.

FIGURE IV** - NEW FORMULATIONS

Formulation Number	INGREDIENT AMOUNT - PERCENT							
	Cab-O-Sil	Natrasol	Veegum	Arlamol E	Adol 63	LexolPG865	Lexemul AS	Varonic L148
462-4-1	1.64	.575	.81	2.20	2.20	2.41	1.55	1.65
462-4-2	1.65	.65	.83	2.20	2.20	2.41	1.55	1.65
462-4-3	1.70	.80	.74	2.20	2.20	2.41	1.55	1.65
462-4-4	1.73	.80	.71	2.20	2.20	2.41	1.55	1.65
462-5-1	1.64	.50	.70	1.00	1.00	4.84	1.55	.80
462-5-2	1.64	.50	.70	3.00	3.00	.79	1.55	2.18
462-5-3	1.25	.56	.80	3.00	3.00	.79	1.55	2.18
462-5-4	1.25	.56	.80	1.00	1.00	4.84	1.55	.80
75907-11-1	1.64	.50	.70	2.20	2.20	2.41	1.55	1.65
75907-11-3	1.64	.50	.70	2.20	2.20	2.41	1.55	1.65
75907-11-5	1.64	.50	.70	2.20	2.20	2.41	1.55	1.65
75907-11-2*	2.75	.50	.70	.86	.86	3.22	4.06	1.03
75907-11-4	2.75	.50	.70	.86	.86	3.22	4.06	1.03
75907-11-6	2.75	.50	.70	.86	.86	3.22	4.06	1.03

*11-2, 11-4, 11-6 - Phase II Formulation

** Figure II, March 1987 monthly report, Phase III

FIGURE V* - FREEZE/THAW STABILITY - % SEPARATION

Formulation	1 Cycle	2 Cycle	3 Cycle	4 Cycle	5 Cycle	6 Cycle	7 Cycle	8 Cycle
462-4-1	T[1]	T	T	T	T	T	T	
462-4-2	0	0	0	T	0	T	0	
462-4-3	0	0	0	T	T	T	0	
462-4-4	0	0	0	0	0	T	0	
462-5-1	3	15	14	21	-	-	-	
462-5-2	T	T	0	T	0			
462-5-3	0	T	0	T	0			
462-5-4	27	-	-	-	-	-	-	
75907-11-1	T	T	T	T	T	T	0	
75907-11-3	0	T	0	0	T	T	T	T
75907-11-5	0	T	T	T	T	T	0	
75907-11-2	4	8	19	19	19	21	-	
75907-11-4	4	6	15	15	17	19	-	
75907-11-6	4	6	15	16	24	-	-	

[1] - Trace - Not Measurable

* Figure III, March 1987 monthly report, Phase III

FIGURE IV **

Restricted

To: C.A. Sterling - Personal Care Products - 230-2S-06
N. A. Randen - Person Care Products - 230-2S-06

From: F. D. Griffith - Medical, Toxicology Services - 230-2S-06

Subject: Potential Toxicity of Arthropod Repellent Formulations

Date: April 2, 1987 (Formulation Corrected June 9, 1987)

3M

It is my opinion that the differences between Formula 1 and Formula 2, below, are toxicologically insignificant.

The changes are small ratio differences of minor constituents which are common cosmetic ingredients.

Ingredient	Formula 1	Formula 2
Cabosil M-5	2.75	1.64
Varonic LI420	0.65	0.65
Varonic LI48	1.03	1.65
Lexemul	4.06	1.55
Carbowax 400	0.98	0.98
Liponic EG-7	2.26	2.26
Veegum	0.70	0.70
Natrasol 250H	0.50	0.50
Lexol PG 865	3.22	2.41
Waxenol 816	0.65	0.65
Arlamol E	0.86	2.20
Adol 63	0.86	2.20
Polymer *	5.83	5.83
DEET *	35.00	35.00
Germaben II	0.22	0.22
Water	To 100%	To 100%

FDG/MAR
FDG:bh (TS84 2.6)

* Corrections

Restricted

** Figure III, March 1987 Monthly Report, Phase III

FIGURE VII

Personal Care Products
Consumer Specialties Division/3M

3M Center
St Paul, Minnesota 55144-1000
612/733 1110

3M

July 20, 1987

Dr. Arturo Castillo
Environmental Protection Agency
Registration Division (TS-767C)
Insecticide-Rodenticide Branch/PM Team 17
401 M Street S.W.
Washington, DC 20460

Dear Dr. Castillo,

Consumer Specialties Division/3M has recently filed an application with EPA for the registration of our Insect/Arthropod Repellent Lotion. In response we have received an EPA File Symbol/Registration No-58007-R. In addition we have received a "Report of Analysis for Compliance with PR Notice 86-5" dated June 3, 1987. While the noted corrections stated in the letter were suppose to accompany "future data submissions", we thought it prudent to submit them now.

Firstly, new compliance with Good Laboratory Practices Standards statements have been obtained. These were signed after the completion of the studies as opposed to those in our original application which stated that the GLP standards would be followed. Three copies of the following statements are enclosed:

MRID 40214902 Volume 3 3M's Insect/Arthropod Repellent Lotion (35% DEET) Acute Oral Toxicity - Rats 3M 60405110-00003.

MRID 40214903 Volume 4 3M's Insect/Arthropod Repellent Lotion (35% DEET) Acute Dermal Toxicity 3M 60405111-00003.

MRID 40214904 Volume 5 3M's Insect/Arthropod Repellent Lotion (35% DEET) Primary Eye Irritation - Rabbit 3M 60405113-00003 and 3M 60405113-00064.

MRID 40214905 Volume 6 3M's Insect/Arthropod Repellent Lotion (35% DEET) Primary Dermal Irritation 3M 60405112-0003

Secondly, the Data Requirement on the title page of MRID 40214901 Volume 2 - Product Chemistry Data Requirements for 3M's Insect /Arthropod Repellant Lotion has been changed from 40 CFR Part 158.120 to Guideline Numbers 61, 62, 63 as requested.

Thirdly, the legibility of some of the material in MRID's 40214902, 40214903, 40214904, 40214905, and 40214906 was reported as marginal. The only page I could see which was hard to read was the assay of the active for the formulation, attached as page 3 of 3 in the confidential section of these studies. This assay has been re-run using black ink instead of blue. Three copies for each study are attached.

Fourthly, the only comment not addressed herein is for MRID 40214904 wherein a repeated washed primary eye irritation study was attached to the original study. It was stated that these should have been bound as separate studies. If this is a major problem I can go ahead and do this and resubmit these as separate studies. Please let me know.

And finally, the letter attachment to the letter to Mr. Tauano comparing 3M's Phase III formulation with the Phase II formulation has been corrected to show that there is only 5.83% acylate polymer in the formulations and not 23.33% as shown. Three copies of the correct form are attached.

If I can be of further assistance please let me know.

Sincerely,

Neil A. Randen
Research Specialist

NAR/cab

Enclosures

Figure VIII

PERCENT SEPARATION VIA FREEZE/THAW CYCLING

Formulation	Freeze/Thaw Cycle Number						
	1	2	3	4	5	6	7
CHP7 (Pilot Batch)	0	0	0	0	0	0	0
CPP7 (Production Trial Batch)	2.9	2.2	3.4	4.0	4.1	4.0	3.7
Phase II Formulations*	4.0	7.0	16.3	16.7	20.0	22.0	--
Laboratory Phase III**	0	.1	0	0	.1	.1	0

* For comparison

** For comparison, Laboratory batch with same composition as production batches. March Monthly Report.

FIGURE IX*

DISPENSIBILITY

Formulation	Container	% Dispensed
Phase I	LDPE	89.2%
Phase I	"Cutter's" Bottle	88.7%
Phase I	"Off" Bottle	88.6%
Phase II	HDPE	88.9 ± 2.5% n=5
Phase II	LDPE	92.1%

* Figure V, March 1987 monthly report, Phase III

FIGURE X

STABILITY CHART

Test Condition	Time Interval	% Separation	pH	Viscosity	% Weight Loss	DEET Analysis	Aesthetic Value
Initial	Zero time						
113°F	1 month						
Room Temp	1 month						
20°F	3 months						
113°F	3 months						
Room Temp	3 months						
113°F	6 months						
Room Temp	6 months						
113°F	1 year						
Room Temp	1 year						
Room Temp	2 years						
Room Temp	3 years						
Room Temp	4 years						
Room Temp	5 years						

Testing part of Phase III Contract

Testing included in Proposed Six Month Extension to Phase III Contract

Testing included in this Revised Proposal

5.2 Appendix B

PILOT BATCH

FORM 1224 (Rev 11/86) PAGE 1 of 6 WALGREEN LABORATORIES, INC.

CONTROL NO. CHB 7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUANTITY 400 Kg. (394 L.) FORM & MEASURE Cream

DATE ADOPTED 6-30-87 SUPERSEDES

ISSUED BY: [signature] DATE: 7/6/87

APPROVED BY: [signature] DATE: 7-6-87

REPRODUCTION CHECKED BY: [signature] DATE: 7-6-87

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.

ORDER NO. AMOUNT FORMULA NO. W.O. NO. WOPIL 20176

	% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
			Date & Time Batch Started: 7-7-87 10:45 AM						
			PART I: Place in a 60 gallon Groen tilt kettle equipped with a propeller type mixer:						
			Kettle Used: #1 tilt Groen Mixer Used: O-1 Checked for Cleanliness By: [signature] Date & Time: 7-7-87 10:50 AM						
			Date & Time Added: 11:00AM 7/7/87						
	35.95	10531C	Purified Water, U.S.P./N.F. Slow mixing	143.8 Kg. (144 L.) (38 Gal.)		MH	SW	MH	S
7/7/87	1.64	10306	Add without mixing, to the water: Date & Time Addition Started: 7-7-87 11:05 AM Amorphous Silicon Dioxide (Cab-O-Sil M-5) Date & Time Addition Completed: 7-7-87 11:20 AM Slowly start to mix.	6.560 Kg.	C780T67	MH	SW	MH	S
	7/7/87 NH 7-7-87		Wash the walls of the kettle with a small amount of Purified Water, U.S.P./N.F. (WPN 10531C).						
			Increase the speed of the propeller mixer so that the batch is mixing thoroughly.						
			Add while mixing:						
			Date & Time Addition Started: 7-7-87 11:35 AM						
	2.26	11318	Polyethylene Glycol (7) Glyceryl Ether (Liponic EG-7)	9.040 Kg.	C866T67	MH	SW	MH	S
	0.98	10384	Polyethylene Glycol (8) (Carbowax 400)	3.920 Kg.	C785T67	MH	SW	MH	S
	0.7	12929	Magnesium Aluminum Silicate (Veegum)	2.800 Kg.	C781T67	MH	SW	MH	S
			Date & Time Addition Completed: 7-7-87 11:45 AM						
			* Now heat Part I to 48° - 50° C. maintaining the temperature no higher than 50° C. while mixing.	* Sample as per the Current Finished Sampling Procedure. Submit 4 fl. oz. Sample to 3M. Sampled By: [signature] Sample Date & Time: 7/7/87					
			Date & Time Heating Started: 7-7-87 - 2:20 PM Date & Time Heating Completed: 7-7-87 - 2:40 PM Final Temperature Attained: 48°C	[signature] 7/7/87					
			Maintain Part I at 48° - 50° C. with constant mixing until ready to be added to Part II.						
			PART II: Place in a 120 gallon Groen kettle equipped with sweep action mixing and side scrapers:	MH = Margie Mathews					
			Kettle Used: #1 Tri-Kettle Checked for Cleanliness By: [signature] Date & Time: 7-7-87 8:30 AM						

NOTICE: ANY PERSON INITIALING WORK DONE, MUST AFFIX THEIR SIGNATURE TO EITHER THIS PAGE OR THE LAST PAGE.

FORM 1224 (Rev. 11/86)

PILOT BATCH

WALGREEN LABORATORIES, INC.

CONTROL NO. CHB 7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUANTITY 400 Kg. (394 L.) FORM & MEASURE Cream

DATE ADOPTED 6-30-87 SUPERSEDES

ISSUED BY: [signature] DATE: 7/6/87

APPROVED BY: [signature] DATE: 7-6-87

REPRODUCTION CHECKED BY: [signature] DATE: 7-6-87

ORDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY
		Date & Time Addition Started: 9:45AM 7/7/87					
26.92	12098	85:7.5:7.5 Mole Ratio Iso-Octyl Acrylate:Stearyl Methacrylate:Acrylic Acid Terpolymer-21.66% in Deet	107.7 Kg.	C789T67	HH	SW	HH
13.91	10534	N,N-Diethyl-M-Toluamide (MGK Diethyltoluamide 95% Meta Isomer Minimum)	55.6 Kg.	C794T67	HH	SW	HH
		Date & Time Addition Completed: 7/7/87 10:51AM					
		Begin to mix Part II with sweep action mixing and side scrapers at a slow speed.					
		Sweep Action Mixer Speed Setting: 6.5					
		Heat Part II to 59° - 61° C. maintaining the temperature no higher than 61° C. while mixing.					
		Date & Time Heating Started: 1:05PM 7/7/87					
		Date & Time Heating Completed: 7/7/87 1:30PM					
		Final Temperature Attained: 58°C					
		Add carefully while mixing:					
		Date & Time Addition Started: 7/7/87 1:35PM					
1.65	12931	Polyethylene Glycol (82) Glyceryl Monotallowate (Varonic L148)	6.600 Kg.	C795T67	HH	SW	HH
0.65	12930	Polyethylene Glycol (200) Glyceryl Monotallowate (Varonic L1420)	2.600 Kg.	C796T67	HH	SW	HH
1.55	11317	Glyceryl Stearate/Sodium Lauryl Sulfate (Lexemul AS)	6.200 Kg.	C784T67	HH	SW	HC
2.41	11315	Propylene Glycol Dicaprylate/Dicaprate (Lexol PG865)	9.640 Kg.	C783T67	HH	SW	HC
0.65	13000	Cetyl Palmitate (Waxenol 816)	2.600 Kg.	C793T67	[illegible]	SW	HC
2.2	10026	Polypropylene Glycol (15) Stearyl Ether (Arlamol E)	8.800 Kg.	C811T67	[illegible]	SW	HC
2.2	10046	Cetyl Stearyl Alcohol (Adol 63)	8.800 Kg.	C797T67	[illegible]	SW	HC
		Date & Time Addition Completed: 7/7/87 2:00PM					
		Maintaining the temperature of Part III II at 59° - 61° C., mix until all the added ingredients are completely dissolved and mixed uniformly.					
		Date & Time Part II Completely Dissolved and Uniform:					

* See back of page. [signature] 7/7/87

[signature] 7/7/87 — [signature] 7-6-87

NOTICE: ANY PERSON INITIALING WORK DONE, MUST AFFIX THEIR SIGNATURE TO EITHER THIS PAGE OR THE LAST PAGE.

Add WPN 12098 directly into 120 Gallon Groen Kettle. Now using same container which was used to weigh 12098, weigh out WPN 10534, making sure to mix & rinse container well.

Robert O Zeutlack (34.CC)

7/7/87

Steve Wozylenko 7/7/87

PILOT BATCH

CONTROL NO. CHB 7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUANTITY 400 Kg. (394 L.) FORM & MEASURE Cream

DATE ADOPTED 6-30-87 SUPERSEDES

ISSUED: [signature] DATE: 7/1/87

APPROVED BY: [signature] DATE: 7-6-87

REPRODUCTION CHECKED BY: [initials] DATE: 7-6-87

ORDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

	% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
[signature] 7-6-87		7/6/87	Heat Part II to 81° - 83° C. along with moderate agitation maintaining the temperature no higher than 83° C. ~~for not more than 5 minutes.~~ *	* Sample as per the current Production Sampling Procedure. Submit 4 fl. oz. sample to 3M. Sampled by: Date & Time					
			Sweep Action Mixer Speed Setting:						
[initials] 7-7-87			Date & Time Heating Started: 7/7/87 - 215 PM						
			Date & Time Heating Completed: 7/7/87 - 230 PM						
7/7/87			Final Temperature Attained: 81° C	[initials] 7/7/87					
		Date & Time	Part II Completely dissolved & Uniform: 7/7/87 2:45 PM						
			Add slowly to Part II while mixing:						
			Date & Time Addition Started: 7/7/87 2:45 PM						
	0.5	11616	Cellulose, 2-Hydroxy Ethyl Ether (Natrasol 250 HR)	2.000 Kg.	C782167	[initials]	[initials]	[initials]	[initials]
			Date & Time Addition Completed: 7/7/87 2:50 PM						
[initials] 7-7-87		7/7/87	Mix Part II until a good dispersion is obtained, about ~~30 minutes.~~ 15 minutes.						
			Mixing Time: 250 PM to 305 PM						
			Date & Time Part II is Uniformly and Well Dispersed: 7/7/87 3:10 PM						
			Increase Part II mixing to give rapid agitation.						
			Sweep Action Mixer Speed Setting: 14						
			With Part II at 81° - 83° C. slowly add Part I.						
			Reheat Part II if necessary to 81° - 83° C.						
			Initial Temperature: 81° C						
			Date & Time Reheating if Necessary Started: Not Necessary						
			Date & Time Reheating if Necessary Completed: Not Necessary						
			Final Temperature Attained: Does Not apply						
			Date & Time Part I Addition Started: 7/7/87, 310 PM						
			Date & Time Part I Addition Completed: 7/7/87 322 PM	* Initial Temperature: 60° C. Reheat Combined Parts I & II to 81-83° C. Date & Time Reheating if Necessary Started: 7-7-87 - 330 PM. Date & Time Reheating if Necessary Completed: 7-7-87 345 PM. Final Temperature Attained: 82° C					
			Rinse Part I kettle with a small amount (less than 1 gallon) of Purified Water, U.S.P./N.F. (WPN 10531C) and add the rinsings to the batch (combined Parts I & II). *						
			Mix the batch for 20 minutes at 81° - 83° C.						
			Mixing Time: 345 PM to 405 PM		[signature] 7/7/87				

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ORM-1224 (Rev. 11/86)

PILOT BATCH

WALGREEN LABORATORIES, INC

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

CONTROL NO.

QUANTITY 400 Kg. (394 L.) FORM & MEASURE Cream

DATE ADOPTED 6-30-87 SUPERSEDES

ISSUED: DATE: 7/6/87

APPROVED BY: DATE: 7-6-87

REPRODUCTION CHECKED BY: DATE: 7-6-87

ORDER NO. AMOUNT FORMULA NO

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
		Force cool the batch with mixing to 37° - 39° C.						
		Adjust the mixing speed while force cooling to maintain an adequate mixing action. Avoid the entrapment of air.						
		Sweep Action Mixer Speed Setting: 12						
		Initial Temperature Before Force Cooling: 81°C						
		Date & Time Force Cooling Started: 7-7-87 - 405 PM						
		Date & Time Force Cooling Completed: 7-7-87 - 530 PM						
		Final Temperature After Force Cooling: 38°C						
		~~Maintaining the batch temperature at 37° - 39° C., add:~~ Then add.						
		Date & Time Addition Started: 7/7/87 5:30 PM						
0.24	10821	Diazolidinyl:Urea:Methyl Paraben:Propyl Paraben:Propylene Glycol (Germaben II)	960 Gm.	C198167	HR	SW	HR	
		Date & Time Addition Completed: 7/7/87 5:35 PM						
		Rapidly force cool the batch with mixing to 31° - 33° C.						
		Initial Temperature Before Force Cooling: 35°C.						
		Date & Time Force Cooling Started: 7-7-87 - 545PM						
		Date & Time Force Cooling Completed: 7-7-87 - 600PM						
		Final Temperature After Force Cooling: 32°C						
		Stop mixing.						
		Measure actual volume using a calibrated dip stick. 350 L.						
		Adjust the batch to its final volume using the product's average density (of 1.015 Gm./ml. or Kg./L.) by adding:						
q.s.'d to 100	10531C	Purified Water, U.S.P./N.F. q.s. to 400 Kg. (394 L.)	44 L. (____ Kg.) (____ Gal.)			HR		HR
		~~Mix the batch until uniform maintaining the temperature at 31° - 33° C.~~						
		Date & Time Batch Uniformity Attained: 7-7-87 600 PM						
		Circulate the batch through a Sonolator using a suitable orifice. Operate the sonolator at a suitable operating pressure. Discard the initial about 5 gallons (19 Kgs) of the batch as passed through the Sonolator.						

14:55 1656 9 GI
#000158 696 9 TA
010821 960 9 HT

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PILOT BATCH

WALGREEN LABORATORIES, INC.

CONTROL NO. CHB 7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUANTITY 400 Kg. (394 L.) FORM & MEASURE Cream

DATE ADOPTED 6-30-87 SUPERSEDES

ISSUED DATE: 7/6/87

APPROVED BY: DATE: 7-6-87

REPRODUCTION CHECKED BY: DATE: 7-6-87

ORDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
		Orifice Size: Medium Size Orifice (0.065)						
		Sonolation Operating Pressure (p.s.i.): 400						
		Sonolator Used: 02						
		Checked for Cleanliness By:						
		Date & Time: 7-7-87 - 5:00 pm						
7/7/87		Date & Time Sonolation Started: 7-7-87	6.58 P.M.					
7-7-87		Date & Time Sonolation Completed: 7-7-87	7-20 P.M.					
		Continue circulation until the entire batch has been sonolated 1 1/2 times.						
		Date & Time Circulation Through the Sonolator Completed:						
7/7/87		Force cool the batch to 31° - 33° C. maintaining the temperature no more than 33° C.						
		Initial Temperature Before Force Cooling:						
		Date & Time Force Cooling Started:						
		Date & Time Force Cooling Completed:						
		Final Temperature After Force Cooling:						
7/7/87		Transfer the batch to clean dry pony bowls through the Sonolator as before through a 30 mesh stainless steel screen.*	*Please Note: A 30 mesh Stainless Steel Screen was not available. So the batch was Sonolated and filled into pony bowls without using any screen. RAW (3rd) 7-7-87			7/7/87		
		*Screen Used:						
		Checked for Cleanliness By:						
		Date & Time:						
7/7/87		The Net wt. of the Product Discarded = 18 Kgs.						
		No. of Bowls Used: 4						
		Checked for Cleanliness By:						
		Date & Time: 7-7-87 - 8:00 pm						
		Bowl Number / Net Weight of Product (Kg.)						
		1 / 103.3						
		2 / 106.1						
		3 / 103.0						
		4 / 76.5						
		Total Wt. 388.9 Kg.						
		Sample according to the following instructions and submit the samples to Quality Control/Quality Assurance for approval.						
		500 ml. sample from bottom of kettle						
		500 ml. sample from top of kettle						
		30 ml. sample from bottom of kettle in sterile bottle						
		30 ml. sample from top of kettle in sterile bottle						

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FORM 1224 (Rev 11/86)

PILOT BATCH

WALGREEN LABORATORIES, INC.

CONTROL NO. CHB7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUANTITY 400 Kg. (394 L.) FORM & MEASURE Cream

DATE ADOPTED 6-30-87 SUPERSEDES

ISSUED BY: [signature] DATE: 7/6/87

APPROVED BY: [signature] DATE: 7-6-87

REPRODUCTION CHECKED BY: da DATE: 7-6-87

ORDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

	% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
			TOP	BOTTOM					
			Sampled By: A. Rawlins	A. Rawlins					
			Sample Date & Time: 7-7-87 7:05 P.M.	7-7-87 7:28 P.M.					
			Quality Control/Quality Assurance Approval:						
			Date & Time of Quality Control/Quality Assurance Approval:						
	[initials] 7/7/87 NAR 7-7-87		Theoretical Weight: 381 ~~400~~ Kg.						
			Actual Weight: 388.9 Kg						
			Acceptable Yield Range: 98 - 102%						
			Percent Actual Yield: 102						
			Calculated By: [signature]						
			Checked By: [signature]						

S.W. = Steve Wasylenko

RAW = Robert A Westlake (3M Co)

AR = Aubrey Rawlins

[initials] = [signature]

NAR = Neil A Rander

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Walgreens

CERTIFICATE OF ANALYSIS

3M INSECT/ANTHROPOD REPELLANT LOTION WPN: 20186 #CHB7
Date of Manufacture 7-7-87

TEST	SPECIFICATIONS	TEST RESULTS
APPEARANCE	White, viscous cream with slight DEET odor.	Smooth, white lotion.
DENSITY	0.995 - 1.035 g/ml	1.004 @ 25°C
VISCOSITY*	150,000 - 250,000 cps (#TE @ 0.6 rpm)	21,600 cps (#TB @ 5 rpm) @ 25°C
pH	6.9 - 7.5	7.4
m.DEET	31.58 - 36.75%	Top = 35.3% w/w Bottom = 34.0% w/w
Bacti: TPC	Not more than 100/ml	10

*VISCOSITY: Conducted on a RVT Model Brookfield Viscometer
*Using #TE @ 0.5 rpm the reading on the scale is 2.0
Using #TE @ 1 rpm the reading on the scale is 2.2
Using #TE @ 5 rpm the reading on the scale is 5
*3M Lab Sample #462-15: Viscosity = 35,600 cps (#TB @ 5 rpm)

Based on Pilot Batch CHB7

FORM 1224 (Rev. 11/86)

PRODUCTION TRIAL

WALGREEN LABORATORIES, INC.

TITLE: 3M INSECT/ARTHROPOD REPELLENT LOTION

WPN: 20186

CONTROL NO.: CPP7

QUAN: ~~3200~~ 2960 Kg. (~~3353~~ 2857 L.)

FORM & MEASURE: Lotion

DATE ADOPTED: 7-22-87

SUPERSEDES:

ISSUED BY: [signature] DATE: 7/22/87

APPROVED BY: William H Lang DATE: 7-22-87

REPRODUCTION CHECKED BY: [signature] DATE: 7-23-87

ORDER NO.: AMOUNT: FORMULA NO.:

MAT'L O.K.:
ALC. REQ.:
ALC. %:
SERIAL NO.:
CODE NO.:
W.O. NO.: W06[illegible]

	% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD. BY	ADD BY	CKD BY
			Date & Time Batch Started: 6:30AM 7-27-87	Calculated By: [signature] Date: 7-23-87					
			PART I: Place in a 600 gallon steam jacketed kettle equipped with a sweep action mixer:	Calc. checked By: [signature] Date: 7-23-87					
			Kettle Used: 600 GAL GREEN Mixer Used: SWEEP Checked for Cleanliness By: [initials] Date & Time: 6:30AM 7-27-87	FACTOR: 0.90625 REASON: Shortage of raw material [illegible] 12086 [signature]					
			Date & Time Added: 6:35AM 7-27-87						
[initials]	35.95	10531C	Purified Water, U.S.P./N.F. intermittent Add with slow mixing, to the water:	1042.6 ~~1150.4~~ Kg. (1043 ~~1150~~ L.) (276 ~~304~~ Gal.)		[initials]	[initials]	[initials]	[initials]
			Date & Time Addition Started: 7-27-87 6:40AM						
	1.64	10386	Amorphous Silicon Dioxide (Cab-O-Sil M-5)	47.6 ~~52.5~~ Kg.	C780767	[initials]	[initials]	[initials]	[initials]
			Date & Time Addition Completed: 7-27-87 7:10AM						
			Slowly start to mix.						
			Wash the walls of the kettle with a small amount of Purified Water, U.S.P./N.F. (WPN 10531C).						
			Increase the speed of the propeller mixer so that the batch is mixing thoroughly. CANNOT CONFORM TO THIS INST. 600 GAL KETTLE HAS ONLY ONE SPEED [initials] 7-27-87					[initials] 7-27-87	
			Add while mixing:						
			Date & Time Addition Started: 7-27-87 ~~7:45AM~~ 7:45AM						
	2.26	11318	Polyethylene Glycol (7) Glyceryl Ether (Liponic EG-7)	65.5 ~~72.3~~ Kg.	C866767	[initials]	[initials]	[initials]	[initials]
	0.98	10384	Polyethylene Glycol (8) (Carbowax 400)	28.5 ~~31.4~~ Kg.	C785767	[initials]	[initials]	[initials]	[initials]
	0.7	12929	Magnesium Aluminum Silicate (Veegum)	20.3 ~~22.4~~ Kg.	C359727	[initials]	[initials]	[initials]	[initials]
			Date & Time Addition Completed: 7-27-87	8:15AM					
			Sample as per the current Ointment Sampling Procedure.						
			Submit 4 fl. oz. sample to 3M Personnel.						
			Sampled By: [initials] Sample Date & Time: 7-27-87 1:09PM						
			Now heat Part I to ~~48°-50° C.~~ (81-83 C.) maintaining the temperature no higher than 50° C. while mixing.						

[signature]

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Based on Pilot Batch CHB7

ORM 1224 (Rev. 11/86)

PRODUCTION TRIAL

PAGE 2 of 6

WALGREEN LABORATORIES, INC.

CONTROL NO. CPP7

ITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

UAN 2900 Kg. (2851 L.) FORM & MEASURE Lotion

ATE ADOPTED 7-22-87 SUPERSEDES

SUED BY: [signature] DATE: 7/22/87

PROVED BY: William H. Lange DATE: 7-22-87

PRODUCTION CHECKED BY: de DATE: 7-23-87

RDER NO AMOUNT FORMULA NO

MAT'L O.K.

ALC. REQ.

ALC. %

SERIAL NO.

CODE NO.

WO NO

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
		Date & Time Heating Started: 1:05PM 7-27-87						
		Date & Time Heating Completed: 1:20PM 7-27-87						
		Final Temperature Attained: 56°C	[initials] 7-27-87 NAR 7-27-87					
		Maintain Part I at ~~48° - 50° C.~~ 51 - 53°C with constant mixing until ready to be added to Part II.						
		PART II: Place in a 1000 gallon steam jacketed kettle equipped with sweep action mixing, side scrapers and agitator:						
		Kettle Used: 1000 GAL GREEN						
		Checked for Cleanliness By: [signature]						
		Date & Time: 7-27-87 9:15AM						
		Date & Time Addition Started: 9:20AM 7-27-87						
26.916	12098	85:7.5:7.5 mole ratio Iso-Octyl Acrylate:Stearyl Methacrylate:Acrylic Acid Terpolymer-21.66% in Deet	780.6 ~~861.3~~ Kg.	C864T67	[initials]	NAR	[initials]	NAR
13.914	10534	N,N-Diethyl-M-Toluamide (MGK Diethyltoluamide 95% Meta Isomer Minimum)	403.6 ~~445.3~~ Kg.	C799T67	[initials]	NAR	[initials]	NAR
		Date & Time Addition Completed: 12:20PM	7-27-87					
		Begin to mix Part II with sweep action mixing and side scrapers at a slow speed.						
		Sweep Action Mixer Speed Setting: 3						
		Heat Part II to 59° - 61° C. maintaining the temperature no higher than 61° C. while mixing.						
		Date & Time Heating Started: 1:00PM 7-27-87						
		Date & Time Heating Completed: 7-27-87 1:20PM						
		Final Temperature Attained: 61°C						
		Add carefully while mixing: add while heating to 59° - ~~60~~ 61°C the following	[initials] 7-27-87 NAR 7-27-87					
		Date & Time Addition Started: 1:50PM 7-27-87 1:50PM	added at 61°C	[initials] 7-27-87 NAR 7-27-87				
1.65	12931	Polyethylene Glycol (82) Glyceryl Monotallowate (Varonic L148)	47.9 ~~52.8~~ Kg.	C795T67	[initials]	SW	[initials]	[initials]
0.65	12930	Polyethylene Glycol (200) Glyceryl Monotallowate (Varonic L1420)	18.9 ~~20.8~~ Kg.	C796T67	[initials]	SW	[initials]	[initials]
1.55	11317	Glyceryl Stearate/Sodium Lauryl Sulfate (Lexemul AS)	45.0 ~~49.6~~ Kg.	C784T67	[initials]	[initials]	[initials]	[initials]
2.41	11315	Propylene Glycol Dicaprylate/Dicaprate (Lexol PG865)	69.9 ~~77.1~~ Kg.	C783T67	[initials]	SW	[initials]	[initials]
0.65	13000	Cetyl Palmitate (Waxenol 816)	18.9 ~~20.8~~ Kg.	C785T67	[initials]	SW	[initials]	[initials]

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Based on Pilot Batch CHB7

FORM 1224 (Rev. 11/86)

PRODUCTION TRIAL

PAGE 3 of 6

WALGREEN LABORATORIES, INC.

CONTROL NO. 1

CPP7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUAN. 3200 Kg. (3155 L.) 2950 2857 FORM & MEASURE Lotion

DATE ADOPTED 7-22-87 SUPERSEDES

ISSUED BY: DATE: 7/22/87

APPROVED BY: William H Rong DATE: 7-22-87

REPRODUCTION CHECKED BY: DATE: 7-23-87

ORDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
2.2	10026	Polypropylene Glycol (15) Stearyl Ether (Arlamol E)	250 Kg. 63.8 ~~70.4~~ Kg.	C35727 C811T67				
2.2	10046	Cetyl Stearyl Alcohol (Adol 63)	63.8 ~~70.4~~ Kg.	C797T67				
		Date & Time Addition Completed: 7-27-87-2:10 PM						
		Heat Part II to 81° - 83° C. along with moderate agitation maintaining the temperature no higher than 83° C..						
		* Sample as per the current Ointment Sampling Procedure.						
		Submit 4 fl. oz. sample to 3M Personnel.						
		Sampled By:						
		Sample Date & Time: 7-27-87						
		Sweep Action Mixer Speed Setting: 3						
		Date & Time Heating Started: 7-27-87-2:10 PM						
		Date & Time Heating Completed: 7-27-87-3:05 PM						
		Final Temperature Attained: 82°C						
		Date & Time Part II Completely Dissolved & Uniform: 7-27-87 3:05 P.M.						
		Add slowly to Part II while mixing:						
		Date & Time Addition Started: 7-27-87-3:10 PM						
0.5	11616	Cellulose, 2-Hydroxy Ethyl Ether (Natrasol 250 HR)	14.5 ~~16.0~~ Kg.	C782T67				
		Date & Time Addition Completed: 7-27-87-3:20 PM						
		Mix Part II until a good dispersion is obtained, about 15 minutes.						
		Mixing Time: 3:20 PM to 3:35 PM						
		Date & Time Part II is Uniformly and Well Dispersed: 7-27-87 3:35 P.M.						
		Increase Part II mixing to give rapid agitation.						
		Sweep Action Mixer Speed Setting: 4						
		Agitator speed setting 9	7-27-87					
		With Part II at 81° - 83° C. slowly add Part I.	NAK 7-27-87					
		Reheat Part II if necessary to 81° - 83° C.						

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Pilot Batch CHB7

ORM 1224 (Rev. 11/86)

PRODUCTION TRIAL

PAGE 4 of 6 WALGREEN LABORATORIES, INC.

ITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

CONTROL NO. CP07

QUAN(2900 3200 Kg. (3857 3153 L.) FORM & MEASURE Lotion

ATE ADOPTED 7-22-87 SUPERSEDES

SSUED BY: [signature] DATE: 7/22/87

PPROVED BY: William F. Lange DATE: 7-22-87

EPRODUCTION CHECKED BY: [signature] DATE: 7-23-87

RDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
		Initial Temperature: 82°C						
		Date & Time Reheating if Necessary Started: Not Necessary						
		Date & Time Reheating if Necessary Completed: Not Necessary						
		Final Temperature Attained: 82°C						
		Date & Time Part I Addition Started: 7-27-87 — 3:35PM						
		Date & Time Part I Addition Completed: 7-27-87 — 3:55PM						
		Rinse Part I kettle with a small amount (about 5 gallons) of Purified Water, U.S.P./N.F. (WPN 10531C) and add the rinsings to the batch (combined Parts I & II).						
		Initial Temperature: 80°C						
		Reheat combined Parts of I & II to 81° - 83° C.						
		Date & Time Reheating if Necessary Started: 7-27-87 - 3:55PM						
		Date & Time Reheating if Necessary Completed: 7-27-87 - 4:15PM						
		Final Temperature Attained: 82°C	* Recirculate a small amount of the product to insure complete uniformity of the batch					
		Mix the batch for 20 minutes at 81° - 83° C.						
		Mixing Time: 4:15PM to 4:35PM		[signature] 7/28/87 [signature] 7-28-87				
		Force cool the batch with mixing to 37° - 39° C.						
		Adjust the mixing speed while force cooling to maintain an adequate mixing action. Avoid the entrapment of air.		16:32 #200015 010821	7.80 kg GF 1.80 kg [illegible] 6.00 [illegible]			
		Sweep Action Mixer Speed Setting: 4 Agitator SPEED — 9		16:38 #100008 010821	[illegible]29 [illegible] 369 [illegible] 960 9 NT			
		Initial Temperature Before Force Cooling: 82°C						
		Date & Time Force Cooling Started: 7-27-87 — 4:40PM						
		Date & Time Force Cooling Completed: 7-27-87 — 8:20PM						
		Final Temperature After Force Cooling: 39°C						
		Then add:						
		Date & Time Addition Started: 7-27-87 — 8:25PM						
0.24	10821	✓ Diazolidinyl Urea:Methyl Paraben:Propyl Paraben:Propylene Glycol (Germaben II)	6.960 7.680 Kg.	C283T17	[initials]	[initials]	[initials]	[initials]
		Date & Time Addition Completed: 7-27-87 - 8:30 PM						

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Based on Pilot Batch CHB7

FORM 1224 (Rev. 11/86) PRODUCTION TRIAL PAGE 5 of 6 WALGREEN LABORATORIES, INC.

CONTROL NO. CPP7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUAN (2410 3200 Kg. (2857 3153 L.) FORM & MEASURE Lotion

DATE ADOPTED 7-22-87 SUPERSEDES

ISSUED BY: [signature] DATE: 7/22/87

APPROVED BY: William D Lange DATE: 7-23-87

REPRODUCTION CHECKED BY: da DATE: 7-23 87

ORDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
		* Measure actual volume using a calibrated dip stick.						
		Actual Volume of the Batch: 2700 L.						
		Adjust the batch to its final volume using the Product's average density (of 1.015 Gm./ml. or Kg./L.) by adding:						
q.s.'d to 100	10531C	Purified Water, U.S.P./N.F. q.s. to ~~3200~~ 2410 Kg. ~~(3153 L.)~~ (2857L.)	157 L. (Kg.) (Gal.)	—	[initials]	NAR	[initials]	NAE
		Rapidly force cool the batch with mixing to 31° - 33° C.						
[initials] 7/27/87	NAE 7-27-87	* Initial Temperature Before Force Cooling: 31°C						
		Date & Time Force Cooling Started: NOT	NEEDED.					
		Date & Time Force Cooling Completed: NOT	APPLICABLE	[initials] 7/27/87				
		Final Temperature After Force Cooling: NOT	APPLICABLE					
		Stop mixing.						
		Date & Time Batch Uniformity Attained: 7-27-87-9:00pm						
		Circulate the batch through a Sonolator using medium size (0.065) orifice and a 30 mesh stainless steel screen attached to the end of the Sonolator. Operate the sonolator at a 350-450 p.s.i. pressure. Discard the initial about 5 gallons (19 Kg.) of the product passed through the Sonolator and through the screen.						
[initials] 7/28/87 NAE 7-28-87		The Actual Quantity of the Product Discarded:	21 KGS.					
		Orifice Size Used: .065						
		Screen Used: NONE						
		Actual Sonolation Operating Pressure (p.s.i.) Employed: 400 PSI						
		Sonolator Used: #02-Ointments						
		Checked for Cleanliness By: [signature]						
		Date & Time: 7-27-87-9:05PM						
		Date & Time Sonolation Started: 7-27-87-10:15 PM						
		Date & Time Sonolation Completed: 7-27-87-10:	40PM					
		Continue circulation until the entire batch has been sonolated 1 1/2 times.						
		Date & Time Circulation Through the Sonolator Completed:						
		~~Bowl 1-3~~ SONOLATION STARTED 10:30AM						
		Bowls 1-3 SONOLATION - FINISHED - 11:30AM						
		Bowls 2-3 SONOLATION STARTED 12:00PM						
		SONOLATION FINISHED 12:35PM → SEE OVERLEAF	PAGE 5 of 6					

NOTICE: ANY PERSON INITIALING WORK DONE, MUST AFFIX THEIR SIGNATURE TO EITHER THIS PAGE OR THE LAST PAGE.

OVERLEAF D p(5&1)

BLADE ON SONOLATOR AERP MOVED CLOSER TO ORIFICE .065 SONOLATION PRESSURE KEPT AT 800 P.S.I. [initials] 7-28-87

BOWLS 6 AND 7 – STARTED-DATE TIME 7-28-87 - 4:00pm FINISHED DATE TIME 7-28-87-4:10pm

CHANGED ORIFICE FROM .065 TO .051 - SONOLATION PRESSURE KEPT AT 800 P.S.I

BOWLS 8 – 7-28-87 – 4:40PM
9 – 6:45PM 7-28-87
10 – 7:00PM
11 – 7:10PM
12 – 9:30 PM
13 – 9:40 PM
(9–13: 7-28-87)
14 – 7:15AM – 7-29-87
15 – 7:20AM
16 – 7:25AM
17 – 10:00AM
18 – 11:15AM
19 – 11:25AM
20 – 4:30 pm
21 – 4:45 pm
22 – 7:45 PM
23 – 8:10 PM
24 – 9:30 PM
25 – 9:45 PM TANK IS EMPTY [initials] 7/29/87

Based on Pilot Batch CHB7

FORM 1224 (Rev. 11/86) **PRODUCTION TRIAL** PAGE 6 of 6 WALGREEN LABORATORIES, INC.

CONTROL NO. CPP7

TITLE 3M INSECT/ARTHROPOD REPELLENT LOTION WPN 20186

QUA. 2900 Kg. (2857 L.) ~~3280 Kg. (3153 L.)~~ FORM & MEASURE Lotion

DATE ADOPTED 7-22-87 SUPERSEDES

ISSUED BY: [signature] DATE: 7/22/87

APPROVED BY: William G. Lange DATE: 7-22-87

REPRODUCTION CHECKED BY: [initials] DATE: 7-23-87

ORDER NO. AMOUNT FORMULA NO.

MAT'L O.K.
ALC. REQ.
ALC. %
SERIAL NO.
CODE NO.
W.O. NO.

% W/W	WPN	INGREDIENTS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY
		Force cool the batch to 31° - 33° C. maintaining the temperature no more than 33° C.						
		Initial Temperature Before Force Cooling: 31°C						
		Date & Time Force Cooling Started: NOT NEEDED		[initials] 7/28/87				
		Date & Time Force Cooling Completed: NOT APPLICABLE						
		Final Temperature After Force Cooling: NOT APPLICABLE						
		Sample according to the following instructions and submit the samples to Quality Control/Quality Assurance for approval.						
		500 ml. sample from bottom of kettle						
		500 ml. sample from top of kettle						
		30 ml. sample from bottom of kettle in sterile bottle						
		30 ml. sample from top of kettle in sterile bottle	Pl. Note:					
		Sampled By: [signature]	All the changes and the modifications made in this formula were made with due authorization from 3M Personnel [signature] 7/28/87					
		Sample Date & Time: 7/28/87 12:45PM						
		Quality Control/Quality Assurance Approval: [signature]						
		Date & Time of Quality Control/Quality Assurance Approval: 7-28-87 1:00 PM						
		* Theoretical Weight: 2881 ~~3181~~ Kg.	[signature] 7-28-87 (3M)					
		Actual Weight:						
		Acceptable Yield Range: 98 - 102%						
		Percent Actual Yield:						
		Calculated By:						
		Checked By:						
		SW = Steve Ukrylenko	* The above was not followed because the batch was q.s.ed to 100% (2900 kg or 2857 L) (2857 L) and it was assumed that the Percent Actual Yield was 100%					
		[initials] = [signature]						
		NDK = Neil A. Kandan 3M						
		UDS = Udo Schnyder						
		RAW = Robert Westlock	[signature] 8/3/87					
		* See other leaf. Steve Ukrylenko 7/28/87 [signature] 7-28-87	[signature] 8-3-87					

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OVERLEAF 8/16/84

After sonolating at pressures of 370, 500, 600, 700 & 800, it was decided the the 800psi gave the best results. The oily appearance seemed to be more finely dispersed at this pressure.

The final ~ 3/4 of the batch will be sonolated at 800psi.

Steve Wayland
Kaufman

As the product is being sonolated into pony bowls, it should be mixed at a low speed to prevent seperation.

Steve Wayland
Kaufman

889

Walgreens

CERTIFICATE OF ANALYSIS

3M INSECT/ARTHROPOD REPELLENT LOTION WPN: 20186 #CPP7
Date of Manufacture 7-27-87

TEST	SPECIFICATIONS	TEST RESULTS
APPEARANCE	White, viscous cream with slight DEET odor.	White lotion, as if separated into tiny droplets.
DENSITY	0.995 - 1.035 g/ml	1.006
VISCOSITY*	150,000 - 250,000 cps (#TE @ 0.6 rpm)	32,900 cps*
pH	6.9 - 7.5	7.5
m.DEET	31.58 - 36.75%	35.3% w/w

*viscosity; Conducted on a RVT Model Brookfield Viscometer
*Using #TB @ 5 rpm

Bill Lange
Asst. Mgr. QC/QA

MASTER PACKAGING FORMULA

PAGE 1 of 2 WALGREEN LABORATORIES, INC.

CONTROL NO. CPP7

FILE 3M INSECT/ARTHROPOD REPELLANT LOTION, 2 AV. OZ. PPOF 028021

QUANTITY 56,338 Only 2 av. oz. FORM & MEASURE Cream

DATE ADOPTED 6-30-87 (Orig.) SUPERSEDES ORDER NO.

ISSUED BY [signature] DATE 7/1/87

APPROVED BY Mary Anne M Kubre DATE 7/7/87 AMOUNT 51,509

PRODUCTION CHECKED BY [signature] DATE 7-28-87 MS NO. 3475

WPN	PACKAGING COMPONENTS	QUANTITY	ORDERED BY	CHECKED BY
	RP (7-28-87) Packaging Line Checked for Cleanliness By: [initials] Date & Time: 7/20/87 1:00 PM 7/28/87	Cln By: [initials] 7-28-87		
	All label and packaging sections of the line have been checked for residual packaging. All such packaging material has been removed.	Cln Ckd By: [initials] 7-28-87		
	Checked By: [initials] Date & Time: 7/20/87 1:00 PM RP (7-28-87) 7/28/87			
	Quality Control/Quality Assurance Approval to Run: M.A. Kubre Date & Time: 7/28/87 1:15 PM			
	Date & Time Packaging This Control Started: 7/28/87 1:15 PM [initials] Kubre			
	Line Used: 15			
	Filling Heads / Tube Coder / Carton Coder — Set By: [initials] / [initials] / —; Checked By: [initials] / [initials] / —; Date: 7/28/87 / 7/28/87 / —; Time: 11:00 AM / 1:00 PM / —			
	Place 2 av. oz. only of:			
20186	3M Insect/Arthropod Repellant	~~3200 Kg.~~ 2881		
	Into:			
61069	2 oz. HDPE Tubes (1 1/2" x 3 1/2") with turret dispensing closure 22/400 finish olive drab color, one color printing.	~~56,338~~ ~~50,221~~ 46,468	[initials]	[initials]
	Suitably crimp the tube closed, imprinting the Control Number on the crimp.			
	Place the tube into the following shipping carton (~~48~~ 66 per shipping carton): which is stenciled 66 only 028021 2 Fl. oz 3M Insect/Arthropod Repellant Lotion CPP7			
40845	Partition	1,173		
40846	Shipping Carton	~~1,173~~ 704 M.A. Kubre [initials]	[initials]	VC
	Now apply the following label to each filled shipping carton:			
77301	5 x 2 1/2 Pressure Sensitive Stock, Permanent Adhesive Shipping Label, White with Black Print	1,173		
	Now print Control Number on shipper label.			
	Attach the following example of labeling used to package this control.			
	Shipper label (or stenciling if used) showing control number.			
	Collect all unused labeling material.			
	Collected By: N. Cole Date & Time: 7-30-87 1:30 PM			
	Collect all unused packaging material.			

(Margin initials: M.A. Kubre)

NOTICE: ANY PERSON INITIALING WORK DO... ...OF PAGE

Form 1111 Rev. 11/86

MASTER PACKAGING FORMULA

PAGE 2 of 2

VALORÉN LABORATORIES, INC.

CONTROL NO. CPP7

TLE 3M INSECT/ARTHROPOD REPELLANT LOTION, 2 AV. OZ. PPOP 028021

ANT: 56,338 Only 2 av. oz. FORM & MEASURE Cream

TE ADOPTED 6-30-87 (Orig.) SUPERSEDES ORDER NO.

SUED BY [signature] DATE 7/6/87

PROVED BY Mary-Anne T. Kubic DATE 7/7/87

PRODUCTION CHECKED BY [signature] DATE 7-28-87

AMOUNT 51,504

MS NO. 3475

	WPN	PACKAGING COMPONENTS	QUANTITY	ORDERED BY	CHECKED BY
		Inspect the line to insure removal of the above, unless the packaging materials are to be used for the next control.			
		Inspected By: [signature]			
		Date & Time: 7-31-87 . 8:00 A.M.			
		Date & Time Packaging This Control Finished: 7-30-87 - 7:30 AM			

NOTICE: ANY PERSON INITIATING WORK DONE MUST AFFIX THEIR SIGNATURE TO THE LAST PAGE

IN-PROCESS CONTROLS

	PAGE 1 of 2	WALGREEN LABORATORIES, INC.
TITLE: 3M INSECT/ARTHROPOD REPELLANT LOTION, 2 AV. OZ.	FPOF 028021	CONTROL NO. CPP7
QUANTITY: 56,338 Only 2 av. oz.	FORM & MEASURE: Cream	
DATE ADOPTED: 6-30-87 (Orig.) SUPERSEDES	ORDER NO.	
ISSUED BY: [signature]	DATE: 7/6/87	
APPROVED BY: Mary-Anne M. Kuber	DATE: 7/7/87	AMOUNT: 51,509
REPRODUCTION CHECKED BY: [signature]	DATE: 7-28-87	MS. NO. 3475

		Calc. By	Checked By
Stated Fill:	2 av. oz.	N/A	N/A
Fill Used (Oz.):	62	[initials]	M.A.K.

Check the total weight every 30 minutes. Check the tube crimp and the shipper label for legibility of control number every 30 minutes.

Weight Range: from total weight to no more than 1/16 av. oz. (2 Gm.) over.

[signature] 7-28 Stencil M.A. Kuber 7/28

Date	Time	Deviation from Total Weight	Checked By	Tube Crimp	Shipper Label	Checked By
7/28/87	1:15 pm	+2 gm	M.A. Kuber	OK	OK	M.A. Kuber
7/28/87	1:42 pm	+1½ gm	M.A. Kuber	OK	OK	M.A. Kuber
7/28/87	2:20 pm	+1½ gm	M.A. Kuber	OK	OK	M.A. Kuber
7-28-87	4:38	+1 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	4:42	+1 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	5:06	+1 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	5:11	+2 gm	H. Bishop	OK	OK	H. Bishop
Changed cap color from white to brown (3M)						
1.0	white = [illegible] at 500 per [illegible] .051 NAR					
	brown = [illegible] at 800 per [illegible] NAR					
	yellow = [illegible] at 800 per [illegible] .051-5 NAR					
7-28-87	5:51 PM	+2 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	6:26	+2 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	7:07	+1 gm	D.C.	O.K.	:	
7-28-87	7:24	+1 gm	B. Hill	OK	OK	B. Hill
7-28-87	7:57	+2 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	9:01	+1 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	9:50	+1 gm	B. Hill	OK	OK	B. Hill
7-28-87	10:01	+1 gm	D.C.	O.K.	O.K.	D.C.
7-28-87	10:53 PM	0	D.C.	O.K.	O.K.	D.C.
7-28-87	11:13	0	D.C.	O.K.	O.K.	D.C.
7-29-87	6:30	+2	D. Fry	O.K.	O.K.	D. Fry
	6:48	+1	HD	ok	ok	HD
7-29-87	7:02	+1	G. Clemons	ok	ok	G. Clemons
	7:35	+1	D. Fry	ok	ok	D. Fry
	8:10	+1	D. Fry	ok	ok	D. Fry
	8:50	0	D. Fry	ok	ok	D. Fry
	9:40	+1	D. Fry	ok	ok	D. Fry
7-29-87	9:51	0	G. Clemons	ok	ok	G. Clemons
	10:00-10:15 10	Filler Down	D. Fry	—	—	—
	11:00	+1	D. Fry	ok	ok	D. Fry
	12:03	0	D. Fry	ok	ok	D. Fry
7-29-87	12:52	0	RJ	ok	ok	RJ
7-29-87	1:35	+1 gm	RJ	ok	ok	RJ
7-29-87	2:08	+1 gm	RJ	ok	ok	RJ
7-29-87	4:10	+1 gm	H. Bishop	OK	OK	H. Bishop
7-29-87	4:11 PM	+1 gm	DC	O.K.	O.K.	DC
7-29-87	5:02	0	D.C.	O.K.	O.K.	D.C.
7-29-87	5:38	0	D.C.	O.K.	O.K.	D.C.
7-29-87	6:25	+1 gm	D.C.	O.K.	O.K.	D.C.
7-29-87	6:57	+1 gm	D. Baker	OK	OK	D. Baker
7-29-87	7:21	+1 gm	D.C.	O.K.	O.K.	D.C.
7-29-87	7:51	0	D. Baker	OK	OK	D. Baker
7-29-87	8:37	0	D.C.	O.K.	O.K.	D.C.
7-29-87	9:14	0	D. Baker	OK	OK	D. Baker
7-29-87	10:02	0	D. Baker	OK	OK	D. Baker
7-29-87	11:10	+1 gm	D.C.	O.K.	O.K.	D.C.
7-29-87	11:50	+1 gm	D.C.	O.K.	O.K.	D.C.
7-30-87	6:33	+1	D. Fry	ok	ok	D. Fry
7-30-87	7:22	+1 gm		OK	OK	G. Clemons

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IN-PROCESS CONTROLS

FORM 1223

PAGE 2 of 2

WALGREEN LABORATORIES, INC.

CONTROL NO. CPP7

TITLE 3M INSECT/ARTHROPOD REPELLANT LOTION, 2 AV. OZ. — PPOF 028021

QUANTITY 56,338 Only 2 av. oz. — FORM & MEASURE Cream

DATE ADOPTED 6-30-87 (Orig.) SUPERSEDES — ORDER NO.

ISSUED BY [signature] DATE 7/6/87

APPROVED BY Mary-Anne M. Kubrc DATE 7/7/87 — AMOUNT 51,509

REPRODUCTION CHECKED BY Michael L. Day DATE 7-28-87 — MS. NO. 3475

DAILY TOTALS

Date	Shipping Carton Count
7-28-87	40
7-28-87	173
7-29-87	263
7-29-87	170
7-30-87	3

PRODUCT RECONCILIATION

	Cases	Units	Calc. By	Checked By
Shipping Carton Count:	649	42,834	RJ	[initials]
Extra Tubes:		0	RJ	[initials]
Samples Taken:		5	RJ	[initials]
Total:		42,839	RJ	[initials]
Theoretical:	~~1,173~~ 704	46,468 ~~56,338~~	RJ	[initials]
% of Theoretical:	92.1	92.1 (see below)	RJ	[initials]

LABELING RECONCILIATION

		Calc. By	Checked By
Tube WPN:	61069		
No. of Tubes Issued:	45,575	RJ	[initials]
No. of Units Packaged:	42,839	RJ	[initials]
No. of Tubes Destroyed:	2066	RJ	[initials]
No. of Tubes Returned:	0	RJ	[initials]
No. of Tubes Unaccounted for:	670	RJ	[initials]

SAMPLING INFORMATION

Take 5 completely packaged units from the packaging line, 4 at the beginning of the run and 1 at the end of the run.

	Samples 1 - 4	Sample 5
Sampled By:	RJ	RJ
Sample Date & Time:	7/28/87 1:20 PM	7/30/87 7:30 AM
Samples Collected By:	M.A. Kubrc	[signature]
Date & Time Samples Collected:	7/28/87 1:20 pm	7-30-87 9:00 AM

Quality Control/Quality Assurance Approval:
Date & Time of Quality Control/Quality Assurance Approval:

*During repackaging keep color coded tape on shipping (3M) cartons MAK Kubrc 7/28/87

NAK - [signature]

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OVERLEAF Ø p(2&2)
In-Process Controls

RR - Ron Rait
D - Helena Chien
A - Helena Smyeck
R - R Jarlowski
MK Mary Knighton
RD Ron Dettman
VC - Vernon Cade

889

GG ONLY 028021 2 FL.OZ.
3M INSECT/ARTHROPOD REPELLANT
LOTION CPP7

MANUFACTURING PROCESS: 1000 Gallon Batch of Insect/Arthropod Repellent Lotion

PROCESS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY

PART I:

Use a 600 gallon steam jacketed kettle equipped with a sweep action mixer.

Kettle Used: _____
Mixer Used: _____
Checked for Cleanliness By: _____
Date/Time: _____

Date/Time Batch Started: _____

Add to the Kettle:

Purified Water, U.S.P./N.F. 3000 lbs.
Date and Time Added: _____ (360 gals.)

Add with intermittent mixing to the water:

Amorphous Silicon Dioxide (Cab-O-Sil M-S) 136.9 lbs.

Date/Time Addition Started: _____
Date/Time Completed: _____

Wash the walls of the kettle with a small amount of Purified Water, U.S.P./N.F.

Add the following while mixing:

Date/Time Addition Started: _____

Polyethylene Glycol (7)
Glyceryl Ether (Liponic EG-7) 188.6 lbs.

Polyethylene Glycol (8) (Carbowax 400) 81.8 lbs.

Magnesium Aluminum Silicate (Veegum) 58.4 lbs

Date/Time Addition Completed: _____

PROCESS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY

Take a 4 ounce retain sample of Part I.

Sampled By: _____
Sample Date/Time: _____

Now heat Part I to 81-83°C (177-182°F) maintaining the temperature no higher than 83°C while mixing.

Date/Time Heating Started: _____
Date/Time Heating Completed: _____
Final Temperature Attained: _____

Determine the volume of Part I at 81-83°C

Volume Determined: _____

Keep Part I suitably covered and maintain at 81-83°C with constant mixing until ready to add to Part II. Check the volume of Part I immediately before the addition of Part I to Part II and compensate for any loss of volume due to evaporation by the addition of Purified Water U.S.P./N.F. as required.

PART II:

Use a 1000 gallon steam jacketed kettle equipped with sweep action and agitator mixing.

Kettle Used: _____
Checked for Cleanliness By: _____
Date/Time _____

Add to the Kettle:

IP-III Polymer 25% in DEET
(3M, 41-4202-1922-6) 1946.9 lbs.

Date/Time Addition Started: _____

N,N-Diethyl m-Toluamide
(MGK Diethyltoluamide 95%
meta isomer minimum) 1460.4 lbs.

Date/Time Addition Completed: _____

PROCESS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY

Begin to mix Part II with side wall scrapers and agitator at a slow speed.

Sweep Action Mixer Speed Setting: 3
Agitator Speed Setting: 5

Start heating Part II to 81-83°C (177-182°F) taking care the temperature rises no higher than 83°C while mixing.

Date/Time Heating Started: _____

Add carefully while heating to 81-83°C the following with continued mixing:

Date/Time Addition Started: _____

Polyethylene Glycol (82) Glyceryl Monotallowate (Varonic LI48)	137.7 lbs.
Polyethylene Glycol (200) Glyceryl Monotallowate (Varonic LI420)	54.2 lbs.
Glyceryl Stearate/Sodium Lauryl Sulfate (Lexemul AS)	129.3 lbs.
Propylene Glycol Dicaprylate/ Dicaprate (Lexol PG 865)	201.1 lbs.
Cetyl Palmitate (Waxenol 816)	54.2 lbs.
Polypropylene Glycol (15) Stearyl Ether (Arlamol E)	183.6 lbs.
Cetyl Stearyl Alcohol (Adol 63)	183.6 lbs.

Date/Time Addition Completed: _____

Continue to heat Part II to 81-83°C with moderate agitation. Maintain 81-83°C until all the ingredients are fully dissolved.

Date/Time 81-83° Attained: _____
Date/Time Part II Completely Dissolved and Uniform: _____

PROCESS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY

Take a 4 ounce retain sample of Part II.

Sampled By: _____
Sample Date/Time: _____

Add slowly to Part II with moderate mixing:

Cellulose, 2-Hydroxethyl Ether (Natrosol 250 HR) 41.7 lbs.

Date/Time Addition Started: _____
Date/Time Addition Completed: _____

Mix Part II until a good dispersion is obtained - about 15 minutes.

Mixing Time: _____ to _____

Check the volume of Part I and adjust to originally measured volume with Purified Water, U.S.P./N.F. if required.

Date/Time Checked: _____
Volume of Phase I: _____
Final Adjusted
Volume of Phase I: _____

Adjust temperature of Phase I to 81-83°C.

Initial Temperature: _____
Date/Time of Reheating: _____
Started: _____
Completed: _____
Final Temperature Attained: _____

Increase Part II mixing to give rapid agitation. Use higher speed settings for the sweep action mixer and the agitator if required.

Sweep Action Mixer Speed Setting: 4
Agitator Speed Setting: 9

With Part I and Part II both at 81-83°C slowly add Part I through a pump and hose to Part II. Maintain vigorous mixing of the batch using the sweep action mixer and the agitator.

Date/Time Part I Addition Started: _____
Date/Time Part I Addition Completed: _____

PROCESS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY

Rinse Part I kettle with a small amount (about 5 gallons) of Purified Water, U.S.P./N.F. and add the rinsings to the combined Part I and Part II batch.

Reheat combined Parts I and II to 81-83°C.

Initial Temperature: _____
Date/Time Reheating Started: _____
Date/Time Reheating Completed: _____
Final Temperature Attained: _____

Mix the batch for 20 minutes at 81-83°C.

Mixing Time _____ to _____

During the mixing time clear 10 gallons of the product from the valve at the bottom of the 1000 gallon kettle and add the cleared material back to the batch. Repeat this clearing procedure at 70°C, at 60°C and at 50°C.

81-83°C	70°C	60°C	50°C

Date/Time Material Cleared:
Cleared By:
Date/Time Cleared Material Added to Batch:

Force cool the batch to 37-39°C (98-102°F) with mixing.

Adjust the mixing speed while force cooling to maintain an adequate mixing action and yet avoiding air entrapment.

Sweep Action Mixer Speed Setting: 4
Agitator Speed Setting: 9

Initial Temperature Before Force Cooling: _____
Date/Time Force Cooling Started: _____
Date/Time Force Cooling Completed: _____
Final Temperature After Force Cooling: _____

Then Add:

Diazolidinyl:Urea:Methyl Paraben:Propyl Paraben:Propylene Glycol (Germaben II) 20.0 lbs.

Date/Time Addition Completed: _____

PROCESS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY

Rapidly force cool the batch to 31-33°C (88-92°F) with mixing.

Initial Temperature Before Force Cooling: _____
Date/Time Force Cooling Started: _____
Date/Time Force Cooling Completed: _____
Final Temperature After Force Cooling: _____

Measure batch volume (using a calibrated dip stick).

Actual Volume of Batch: _____ gallons.

Adjust the batch to its final volume by adding:

Purified Water, U.S.P./N.F. q.s. to 1000 Gallons.

Mix an additional 30 minutes to a uniform batch.

Mixing Time From: _____ to _____
Date/Time Batch Uniformity Attained: _____

Circulate the batch through a Sonolator (or other suitable homogenizer) discharging the product below the surface of product through the port at the top and back of the 1000 gallon kettle. Operate the sonolator using a small (0.051-S) orifice at 775-825 p.s.i. pressure with the knife edge of the sonolator adjusted as close to the orifice as possible. Discard the initial product (about 5 gallons, 19 Kg) passed through the sonolator.

Sonolator Used: _____
Checked for Cleanliness By: _____
Date/Time: _____

Orifice Size Used: _____
Sonolator Operating Pressure Used: _____
Actual Quantity of Product Discarded: _____

Date/Time Sonolation and Circulation Started: _____

PROCESS	QUANTITY	INGRED. CONTROL NUMBER	MSRD BY	CKD BY	ADD BY	CKD BY

Continue sonolation and circulation as above until the entire batch has been sonolated 1-1/2 times.

Date/Time Circulation through the Sonolator Completed: _____

Force cool the batch to 31-33°C if needed.

Initial Temperature Before Force Cooling: _____
Date/Time Force Cooling Started: _____

Date/Time Force Cooling Completed: _____
Final Temperature After Force Cooling: _____

Sample the final lotion according to the following instructions and submit the samples to Quality Control/Quality Assurance for approval.

500 ml sample from bottom of kettle
500 ml sample from top of kettle
30 ml sample from bottom of kettle in sterile bottle
30 ml sample from top of kettle in sterile bottle

Sampled By: _____
Sample Date/Time: _____
Quality Control/Quality Assurance Approval: _____
Date/Time of Quality Control/Quality Assurance Approval: _____

Theoretical Yield: 995 Gallons
8428 Lbs.
3823 Kgs.

5.3 Appendix C

PACKAGE SPECIFICATIONS FOR TUBE, CAP, SHIPPING CARTON AND LABEL:

TUBE

Style: Plastic Tube

Material: High Density Polyethylene

Color: Custom color olive drab

Size: 2 ounce, nominal

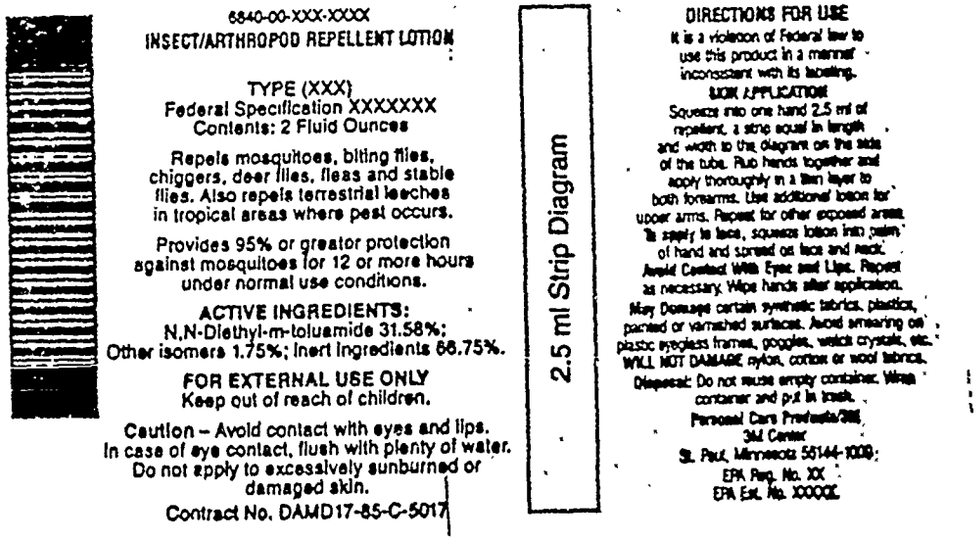
Dimensions: 1-1/2" Diameter x 3-3/16" Long (Fill Length)
Orifice size: 0.187; Head: 22/400

Weight: 7.71g ± 0.16g

Printing: 2 color - White and Black with
TP-46 epoxy resin barrier coating

Source: Tubed Products Inc.
Easthampton, MA

Copy:



CAP

Style: FT

Material: Low Density Polyethylene

Color: Custom color olive drab

Finish: 22/400

Seal Type: Land

Orifice Size: 3.5 mm x 7.5 mm

Part Number: PS 118

Source: Polytop Corporation
Slatersville, RI

SHIPPING CARTON

Style: Assembled Partition

Material: 125 lb test, KRAFT Board Type, C Flute

Dimensions:

1. One set of assembled partitions consisting of:

   Part "A" Size: 12-1/4 x 4-11/16" (7 required)
   Part "B" Size: 16-3/8 x 4-11/16" (5 required)

2. Assemble Part "A" with Part "B" to form a 48 cell partition

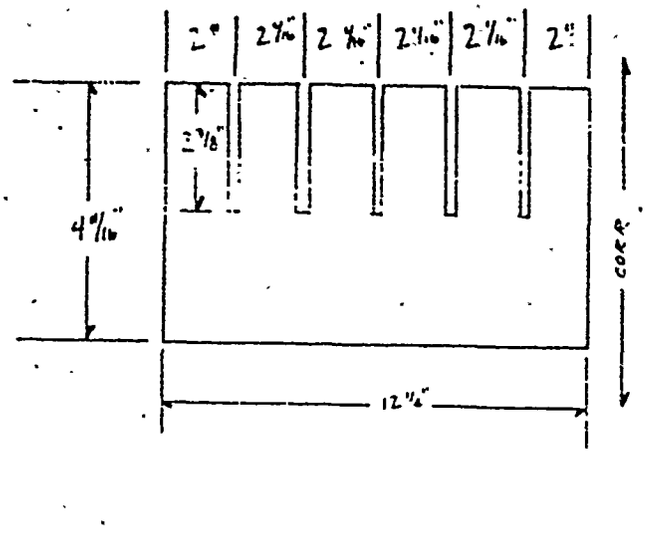
3. After assembly knock down flat

4. See below for dimensions of Part "A" and Part "B"

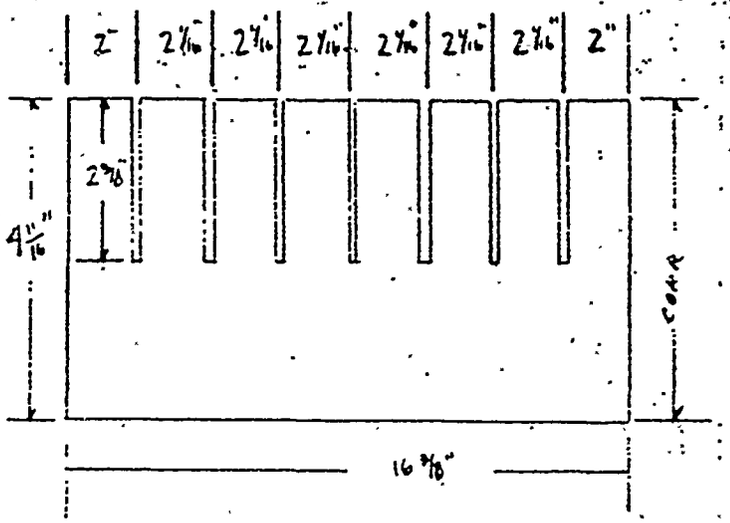
THE PROVISIONS OF THIS SPECIFICATION WILL BE THE BASIS FOR ACCEPTANCE OR REJECTION OF THE MATERIAL.

DISTRIBUTION CODE: EWJ-13

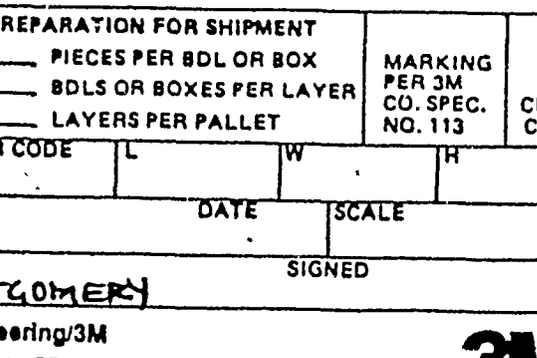
PART "A"



PART "B"



CELL ARRANGEMENT:



WHERE USED SEE PAGE ONE

PACKING AS PER 3M SPEC. NO. 123	PREPARATION FOR SHIPMENT: ____ PIECES PER BDL OR BOX; ____ BDLS OR BOXES PER LAYER; ____ LAYERS PER PALLET	MARKING PER 3M CO. SPEC. NO. 113	CLASS CODE

COMMON MASTER CODE	L	W	H

DRAWN | DATE | SCALE

PKG. ENG. P. MONTGOMERY | SIGNED

Package Engineering/3M
St. Paul, Minnesota 55144-1000

3M

ISSUE	ISSUE DATE AND CHANGE RECORD	
A	7-14-87 SEE PAGE ONE	APP

DIVISION	PROJECT	DIVISION CODE
PCP		EW

TITLE: PARTITION, ASSEMBLED

CLASSIFICATION NO.

DWG. Size	IDENTIFICATION NO.	ISSUE
A	34-7023-5018-1	A

Form 7042-XLF.PWP

LABEL

Front Label

6840-00-XXX-XXXX
INSECT/ARTHROPOD REPELLENT LOTION
TYPE (XXX)
Federal Specification XXXXXXX
Contents: 2 Fluid Ounces

Repels mosquitoes, biting flies, chiggers, deer flies, fleas and stable flies. Also repels terrestrial leeches in tropical areas where pest occurs.

Provides 95% or greater protection against mosquitoes for 12 or more hours under normal use conditions.

ACTIVE INGREDIENTS: N,N-Diethyl m-toluamide 31.58%
Other isomers 1.75%; inert ingredients 66.75%.

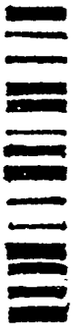
FOR EXTERNAL USE ONLY
Keep out of reach of children.

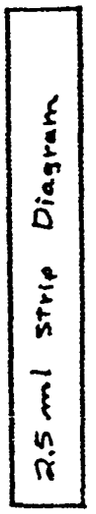
Caution - Avoid contact with eyes and lips. In case of eye contact, flush with plenty of water. Do not apply to excessively sunburned or damaged skin.

Contract No. DAMD17-85-C-5017

Back Label

DIRECTIONS FOR USE
It is a violation of Federal Law to use this product in a manner inconsistent with its labeling.
SKIN APPLICATION
Squeeze into one hand 2.5 ml of repellent, a strip equal in length and width to the diagram on the side of the tube. Rub hands together and apply thoroughly in a thin layer to both forearms. Use additional lotion for upper arms. Repeat for other exposed areas. To apply to face, squeeze lotion into palm of hand and spread on face and neck. Avoid Contact With Eyes and Lips. Repeat as necessary. Wipe hands after application.





May Damage certain synthetic fabrics, plastics, painted or varnished surfaces. Avoid smearing on plastic eyeglass frames, goggle, watch crystals, etc. WILL NOT DAMAGE nylon, cotton or wool fabrics.

Disposal: Do not reuse empty container. Wrap container and put in trash.

Personal Care Products/3M
3M Center
St. Paul, Minnesota 55144-1000

EPA Reg. No. XX
EPA Est. No. XXXXX

5.4 Appendix D

INSECT REPELLANT
LS9061-0680-USA87
28-Aug-87

	BATCH SIZE: 1000 GALLONS	BATCH SIZE: 800 GALLONS	BATCH SIZE: 600 GALLONS
	NOV '87	NOV '87	NOV '87
	OPTION 1	OPTION 2	OPTION 3
LABOR	$4,651	$4,651	$4,651
HOURS	160	160	160
OVERHEAD	4,382	4,382	4,382
MATERIALS/SUPPLIES	0	0	0
TRAVEL	2,199	2,199	2,199
SUBCONTRACTOR & RAW MATERIALS:	28,045	23,428	18,812
SUBTOTAL	$39,197	$34,590	$29,964
G&A 22.56%	8,843	7,801	6,760
IR&D 5.00%	1,960	1,729	1,498
TOTAL	$50,000	$44,111	$38,222
FEE 0.00%	$0	$0	$0
TOTAL	$50,000	$44,111	$38,222
FACITITIES COST OF CAPITAL	$30	$30	$30
TOTAL PROPOSAL	$50,030	$44,141	$38,252

NOTE: Possible rounding differences

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********** the use of selected 3M personnel only.

INSECT REPELLANT
LS9051-068C-USA87

T R A V E L

OPTION	TASK	MONTH	LOCATION	PURPOSE		HOTEL	MEALS	GROUND TRANSP	AIR (2 WAY)	TOTAL PER TRIP	TOTAL WITHOUT INFLATION	TOTAL INCLUDIN INFLATIO
1	1	NOV '88	CHICAGO, IL.	PROGRAM REVIEW	RATES	80	33	45	410			
					3 DAY(S)/ 2 NIGHT(S)	2	3	3				
					3 PERSON(S)	3	3	1	3			
					1 TRIP(S)							
						480	297	135	1230	2142	2142	2,176
2	1	NOV '88	CHICAGO, IL.	PROGRAM REVIEW	RATES	80	33	45	410			
					3 DAY(S)/ 2 NIGHT(S)	2	3	3				
					3 PERSON(S)	3	3	1	3			
					1 TRIP(S)							
						480	297	135	1230	2142	2142	2,176
3	1	NOV '88	CHICAGO, IL.	PROGRAM REVIEW	RATES	80	33	45	410			
					3 DAY(S)/ 2 NIGHT(S)	2	3	3				
					3 PERSON(S)	3	3	1	3			
					1 TRIP(S)							
						480	297	135	1230	2142	2142	2,176